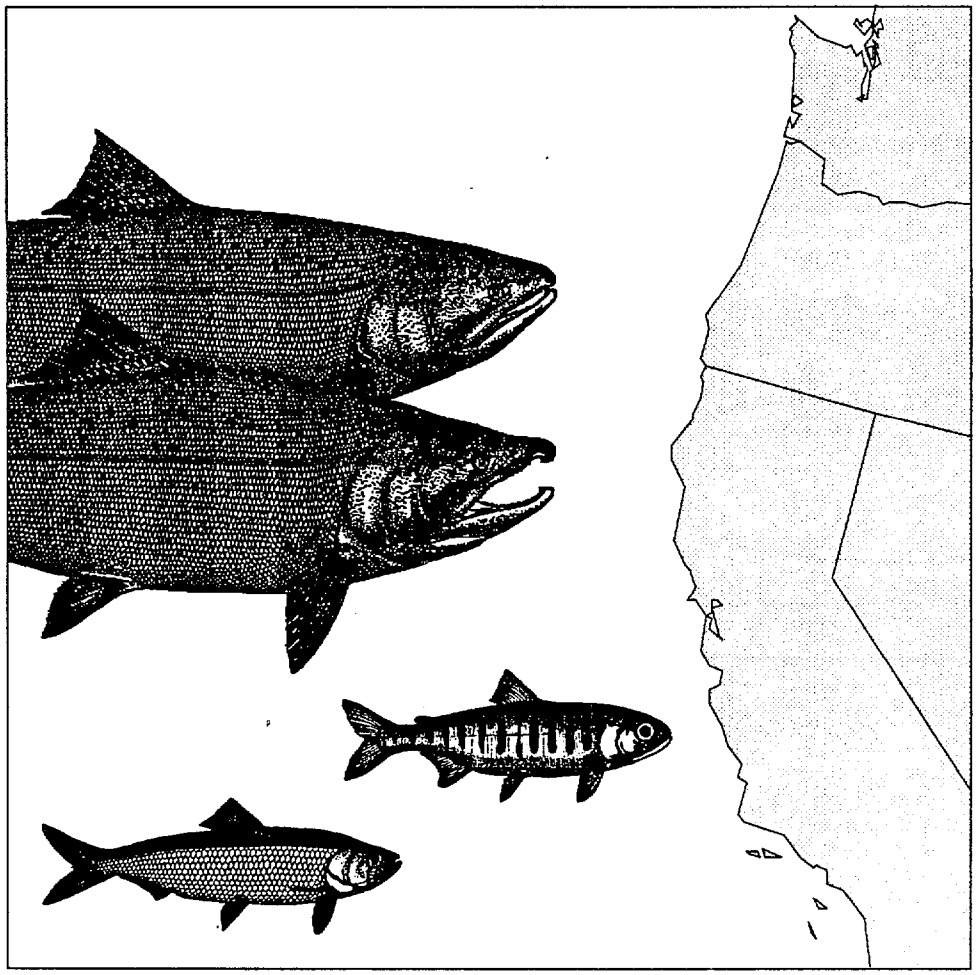
NOAA's Estuarine Living Marine Resources Project

Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries Volume I: Data Summaries



March 1990

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

NOAA's Estuarine Living Marine Resources Project

In June 1985, the National Oceanic and Atmospheric Administration (NOAA) began a project to develop a comprehensive information base on the life history, relative abundance and distribution of fishes and invertebrates in estuaries throughout the Nation (Monaco 1986). This project, the Estuarine Living Marine Resources (ELMR) project, is conducted jointly by the Strategic Assessment Branch (SAB) of the Office of Oceanography and Marine Assessment and laboratories of the National Marine Fisheries Service (NMFS). Currently, the Point Adams (Hammond), OR; Galveston, TX; Beaufort, NC; and Oxford, MD laboratories are compiling information for the contiguous West Coast, Gulf of Mexico, Southeast, and Northeast regions.

To date, the project has compiled data for 115 species in 73 estuaries. Four reports have been published: State of Washington (Monaco and Emmett 1988); State of Texas (Monaco et al. 1989); Eastern Gulf of Mexico (Williams et al. 1990), and this volume. Scheduled for publication in 1990 are reports for the Central Gulf of Mexico (Mississippi Sound, MS, through Calcasieu Lake, LA); the West Coast *Vol. 2: Life History Profiles*; and the Southeast (Albemarle Sound , NC, through Biscayne Bay, FL).

Three salinity zones, as defined in Volume 1 of NOAA's *National Estuarine Inventory Data Atlas* (NOAA 1985), provided the spatial framework for organizing information on species distribution and abundance within each estuary. These salinity zones are tidal fresh (0.0 to 0.5 ppt), mixing (0.5 to 25.0 ppt), and seawater (25.0 and greater ppt). The primary data developed for each species for each salinity zone include spatial and temporal distributions and relative abundance by life history stage, e.g., adult, spawning or mating, juvenile, larva, and egg. In addition, a detailed estuarine life history profile is written for each species.

Additional information on this or other projects of the Strategic Assessment Branch is available from:

Strategic Assessment Branch
Office of Oceanography and Marine Assessment
National Oceanic and Atmospheric Administration
6001 Executive Blvd., Rm. 220
Rockville, Maryland 20852
(301) 443-0453

Reports available from NOAA's Estuarine Living Marine Resources project include:

Monaco, M. E., et al. 1989. Distribution and Abundance of Fishes and Invertebrates in Texas Estuaries. ELMR Rpt. No. 3. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 107 p.

Monaco, M. E., et al. 1990. Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries, Volume I: Data Summaries. ELMR Rpt. No. 4. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 240 p.

Bulger, A. J., et al. 1990. A Proposed Estuarine Classification: Analysis of Species Salinity Ranges. ELMR Rpt. No. 5. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 28 p.

Williams, C. W., et al. 1990. Distribution and Abundance of Fishes and Invertebrates in Eastern Gulf of Mexico Estuaries. ELMR Rpt. No. 6. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 105 p.

Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries, Volume I: Data Summaries

Project Team

Mark E. Monaco* **and David M. Nelson**
Strategic Assessment Branch
Ocean Assessments Division
Office of Oceanography and Marine Assessment
National Ocean Service
Rockville, MD 20852

Robert L. Emmett and Susan A. Hinton
Point Adams Biological Field Station
Coastal Zone and Estuarine Studies Division
Northwest Fisheries Center
National Marine Fisheries Service
Hammond, OR 97121

Property of CSC Library

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

ELMR Report Number 4

March 1990

* Contact for copies of this report.

Acknowledgments

The authors thank those individuals who provided information and reviewed the data in this report, and the many other scientists and managers who provided contacts and references. They also thank Susan E. Holliday for her assistance in preparing the data summaries.

This report should be cited as:
Monaco, M. E., et al. 1990. Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries, Volume I: Data Summaries. ELMR Rpt. No. 4. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 240 p.

QL139 .D57 1990 no.4
22104802
DEC 4 1996

Contents

Introduction 1

Why Conduct ELMR? 1

Data Collection and Organization 2

Selection of Estuaries 2
Selection of Species 3
Species Profiles 4
Data Sheets 4
Data Verification 6

Data Summaries 6

Data Content and Quality 6

Variability in Space and Time 7
Abundance Data 7

Use of ELMR Data 7

Classifying and Comparing Estuaries 7
Linkages to Marine Ecosystems 7

Concluding Comments 8

Literature Cited 8

Data Summary Tables 10

Spatial distribution and relative abundance 11
Temporal distribution 48
Data reliability 148
Presence/absence of 47 species in West Coast estuaries 185

Appendices 198

Appendix 1. National Estuarine Inventory map of Grays Harbor 199
Appendix 2. Species profile and sample data sheet: Pacific herring 200
Appendix 3. Table of references and personal communications 205
Appendix 4. Personal communications 216
Appendix 5. References 219

List of Figures

Figure 1: ELMR regions 1
Figure 2: Major steps to complete the West Coast study 2
Figure 3: West Coast estuaries 3
Figure 4: Example of a species/estuary data sheet: Pacific herring in the Columbia River estuary 5

List of Tables

Table 1: West Coast species list 4
Table 2: Spatial distribution and relative abundance 11
Table 3: Temporal distribution 48
Table 4: Data reliability 148
Table 5: Presence/absence of 47 species in West Coast estuaries 185

Introduction

This report is the first of two volumes that present information on the spatial and temporal distribution, relative abundance, and life history characteristics of 47 fish and invertebrate species in 32 estuaries along the contiguous West Coast of the U.S. Its purpose is to disseminate data developed in NOAA's *Estuarine Living Marine Resources* (*ELMR*) project (see inside front cover). ELMR is a joint study by NOAA's National Ocean Service and National Marine Fisheries Service (NMFS). The study framework, sample data sheet, and species life history profile presented are illustrative of the nationwide ELMR project. Volume II will be published in 1990 and will focus on how individual species utilize estuaries and on their life history characteristics. Distribution and abundance information, results of multivariate analyses to define species and estuary assemblages, and salmonid hatchery and escapement information will be presented.

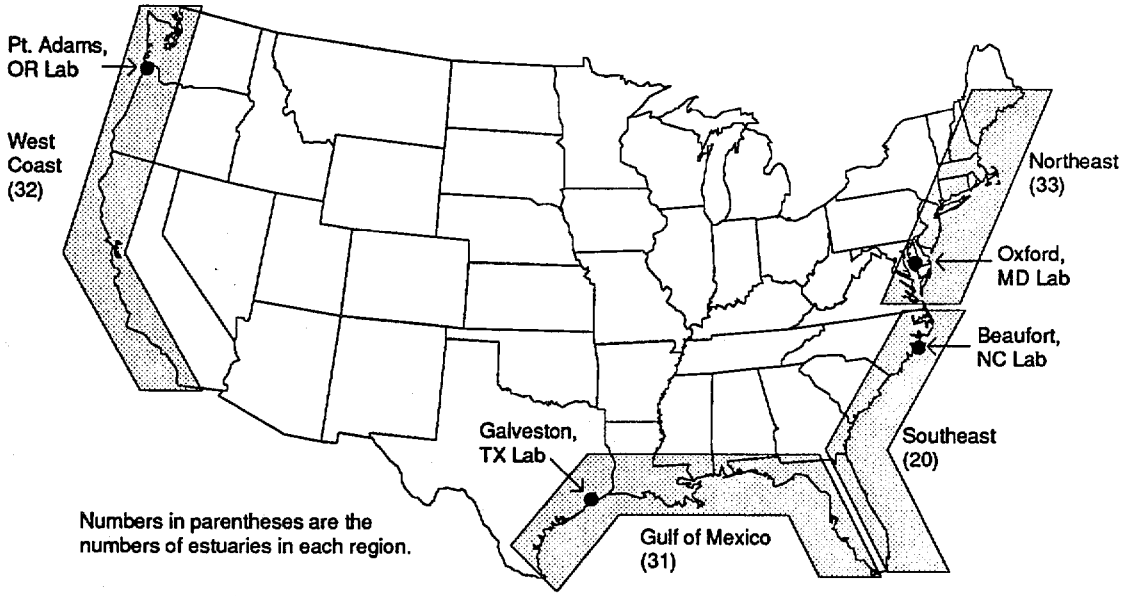
The objective of ELMR is to develop a consistent data base on the distribution and abundance of selected fishes and invertebrates in the Nation's estuaries. The nationwide data base is divided into four regions (Figure 1). The relative abundance and monthly occurrence of life stages of each species are recorded by estuary for three salinity zones (seawater, mixing, and tidal fresh) identified in NOAA's *National Estuarine Inventory* (NEI) *Data Atlas: Volume I* (NOAA 1985). When completed, the entire data base will contain information for approximately 150 fish and invertebrate species found in over 120 U. S. estuaries.

Why Conduct ELMR?

Estuaries are among the most productive natural systems (Mann 1982, Odum and Heald 1975). The physical, chemical, and biological components of estuaries are critical to many living resources (Gunter 1967, Weinstein 1979). They are important nursery areas that provide food, refuge from predation, and valuable habitat for many species (Joseph 1973). Estuarine organisms that support important commercial and recreational fisheries include salmonids, crabs, and shrimp. In spite of the well documented importance of these areas to fish and invertebrate populations, few consistent and comprehensive data sets exist that allow examinations of the relationships of many estuarine species found in or among groups of estuaries. Most of the distribution and abundance data for estuarine-dependent species are for the offshore life stages where major sampling programs have focused, and does not describe estuarine distributions adequately (Darnell et al. 1983, NOAA 1988).

Only a few comprehensive sampling programs, e.g., State of Texas (Hammerschmidt and McEachron 1986, McEachron and Green 1984), collect fishes and invertebrates with identical methods across groups of estuaries within a region. Because of the variability in sampling strategies, much of the existing estuarine fisheries data cannot be compared among estuaries. In addition, existing programs do not focus on how groups of estuaries may be important for regional management of fishery resources. Most of the existing comprehensive estuarine data are for relatively few important commercial and recreational species.

Figure 1. ELMR regions.



Since life stages of many species use both estuarine and marine habitats, it is necessary to combine information on distribution, temporal utilization, and life history strategies to understand the linkages between estuaries and nearshore/offshore areas. To date, a national, comprehensive, and consistent data base of this type does not exist. Consequently, there is a need to develop a framework that integrates the fragments of information on marine and estuarine species and their associated habitats into a useful, comprehensive, and consistent structure. NOAA's ELMR project was designed to help fulfill this need by developing a uniform, nationwide data base on selected estuarine species. Results will complement other NOAA efforts to formulate a national estuarine assessment capability (NOAA 1985) and oceanic fishery sampling programs (e.g., Sherman and Alexander 1985). Compiling this information also identifies data gaps and assesses the content and quality of existing estuarine fisheries data.

Data Collection and Organization

Figure 2 shows the major steps taken to collect and organize information on the distribution and abundance of fishes and invertebrates in West Coast estuaries.

Selection of Estuaries. Estuaries and marine embayments of the West Coast (Figure 3) were initially selected from the *National Estuarine Inventory Data Atlas: Volume I* (NOAA 1985). However, 13 additional West Coast estuaries were added to the NEI due to their biological importance.

Data on the spatial and temporal distributions of species were developed and organized based on the tidal fresh (0.0 to 0.5 ppt) , mixing (0.5 to 25.0 ppt), and seawater (25.0 and greater ppt) zones delineated for each estuary in the NEI. A representative map and data table (Grays Harbor) from the NEI is shown in Appendix 1. Some West Coast embayments do not contain all three salinity zones. For example, southern California estuaries and embayments generally have only seawater zones and contain little or no tidal fresh and mixing zones. However, they were included because they provide important habitat for many euryhaline estuarine species.

Compiling large amounts of data limits the amount of information that can be organized and presented for each species/estuary combination. It would be time and cost prohibitive to map each species by life stage for each estuary (Monaco 1986). Thus, the salinity zone framework allows the available information on estuarine fish and invertebrate distribution to be consistently compiled and organized.

Figure 2. Major steps to complete the West Coast study.

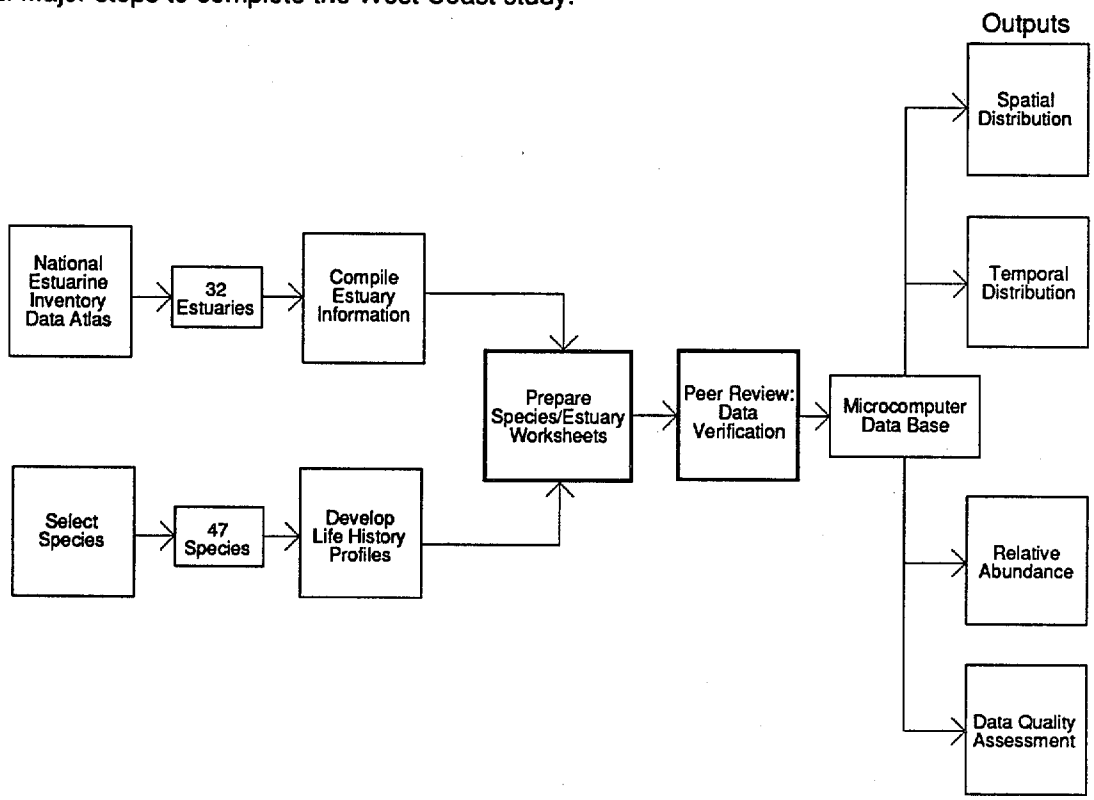
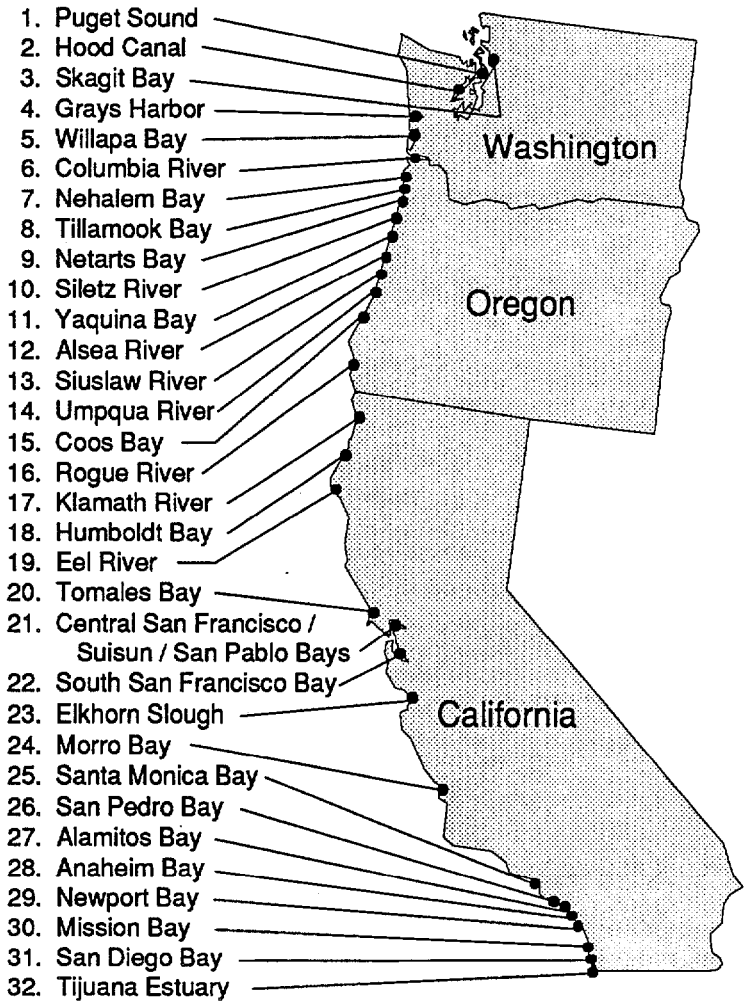


Figure 3. West Coast estuaries.



Selection of Species. Four criteria were used to identify 47 species that had been studied in detail. Many of the selected species are either commercially or recreationally important, and thus data on them are most available. Species of ecological value or indicators of environmental stress were also chosen. Also, eight races of Pacific salmon (*Oncorhynchus* spp.) from two species were chosen. A species list (Table 1) was developed and peer reviewed to ensure that the most "important" species were studied. The four criteria were:

1) Commercial value – determined by a review of catch data and value statistics from NMFS (e.g., Pacific herring, *Clupea pallasi*, and Dungeness crab, *Cancer magister*).

2) Recreational value – defined as a species that recreational fishermen specifically try to catch that may or may not be of commercial importance. Recreational species were determined by consulting regional experts and NMFS reports (e.g., steelhead, *Oncorhynchus mykiss*, and California halibut, *Paralichthys californicus*).

3) Indicator species of environmental stress – identified from the literature, discussions with fisheries experts, and from monitoring programs such as NOAA's National Status and Trends Program (NOAA 1984). These species were mollusks or bottom fishes that consume benthic invertebrates or have a strong association with bottom sediments. Their physiological disorders, morphological abnormalities, and bioaccumulation of contaminants such as heavy metals, indicate environmental pollution and/or stress (e.g., Pacific oyster, *Crassostrea gigas*, and white croaker, *Genyonemus lineatus*).

4) Ecological value – based on several attributes, including trophic level, relative abundance, and evidence of its importance as a key predator or prey species (e.g., bay shrimp, *Crangon franciscorum*, and topsmelt, *Atherinops affinis*).

Table 1. West Coast species list.

Scientific name	Common name
Mytilis edulis	blue mussel
Crassostrea gigas	Pacific oyster
Tresus capax	horseneck gaper
Tresus nuttali	Pacific gaper
Tagelus californianus	California jacknife clam
Protothaca staminea	Pacific littleneck clam
Venerupis japonica	Manila clam
Mya arenaria	Eastern softshell clam
Panope abrupta	geoduck
Crangon franciscorum	bay shrimp
Cancer magister	Dungeness crab
Triakis semifasciata	leopard shark
Acipenser medirostris	green sturgeon
Acipenser transmontanus	white sturgeon
Alosa sapidissima	American shad
Clupea pallasi	Pacific herring
Anchoa compressa	deepbody anchovy
Anchoa delicatissima	slough anchovy
Engraulis mordax	northern anchovy
Oncorhynchus clarki	cutthroat trout
Oncorhynchus gorbuscha	pink salmon
Oncorhynchus keta	chum salmon
Oncorhynchus kisutch	coho salmon
Oncorhynchus mykiss	steelhead (3 races)
Oncorhynchus nerka	sockeye salmon
Oncorhynchus tshawytscha	chinook salmon (5 races)
Hypomesus pretiosus	surf smelt
Spirinchus thaleichthys	longfin smelt
Thaleichthys pacificus	eulachon
Microgadus proximus	Pacific tomcod
Atherinops affinis	topsmelt
Atherinopsis californiensis	jacksmelt
Gasterosteus aculeatus	threespine stickleback
Morone saxatilis	striped bass
Paralabrax clathratus	kelp bass
Paralabrax nebulifer	barred sand bass
Genyonemus lineatus	white croaker
Atractoscion nobilis	white seabass
Cymatogaster aggregata	shiner perch
Ammodytes hexapterus	Pacific sand lance
Clevelandia ios	arrow goby
Ophiodon elongatus	lingcod
Leptocottus armatus	Pacific staghorn sculpin
Paralichthys californicus	California halibut
Hypsopsetta guttulata	diamond turbot
Pleuronectes vetulus	English sole
Platichthys stellatus	starry flounder

Species Profiles. A life history profile for each species was developed to provide an overview of how it utilizes estuaries. The profiles are essential in understanding the distribution of each species. Although many species profiles have been published previously, they often describe estuarine life stages inadequately. Therefore, the profiles emphasized estuarine ecology, salinity and temperature ranges, and life history information for estuarine-dependent life stages. A representative species profile for Pacific herring is shown in Appendix 2. Volume II will contain a profile for each species.

Data Sheets. A data sheet was developed for each species for each estuary to enable quick compilation and simple presentation of the data. Figure 4 shows the data sheet for Pacific herring in the Columbia River estuary. A draft of each data sheet was developed by project staff and reviewed by local experts. Data compiled for each species include: 1) the salinity zone it occupies (seawater, mixing, or tidal fresh); 2) monthly distribution in the zones; and 3) life history stage(s) in a particular zone and their relative abundance level. The ELMR data are stored in a microcomputer data base management system.

The relative abundance of a species was classified using the following definitions:

- *Not present*: species or life history stage not found, questionable data as to identification of species, and/or recent loss of habitat or environmental degradation suggests absence.
- *No information available*: no data available, and after expert review it was determined that not even an educated guess would be appropriate.
- *Rare*: species is present but not frequently encountered.
- *Common*: species is generally encountered but not in large numbers; does not imply an even distribution over a specific salinity zone.
- *Abundant*: species is often encountered in substantial numbers relative to other species.
- *Highly abundant*: species is numerically dominant relative to other species.

Adults were defined as sexually mature individuals, juveniles as immature but otherwise similar to adults, and spawning as the release of eggs and sperm (fertilization). A few exceptions existed, such as mating of Dungeness crab, and parturition (live birth) of the viviparous leopard shark (*Triakis semifasciata*) and shiner perch (*Cymatogaster aggregata*). For Pacific oyster, spawning, larvae, and eggs are not shown because spawning is sporadic; most spat is hatchery produced and placed on beds.

Because migrating juveniles of different races of chinook salmon are difficult to distinguish in the field, the data on juvenile chinook salmon were combined. In general, yearling juveniles (spring and winter

races) migrate earlier than subyearling juveniles (fall races). The following terms are defined to help interpret the salmonid data:

- *Race*: A specific "run" of salmon defined by when the adults enter natal rivers to spawn. For example, spring chinook salmon is the race that enters rivers during spring. A *stock* of salmon is usually defined by both the time and location of spawning, thus, a race may be composed of many stocks.

- *Half-pounder*: Juvenile steelhead that migrate to sea in spring, but do not overwinter at sea their first year. Instead, they return to rivers to overwinter, and migrate to sea again the following spring.

- *Kelt*: An adult steelhead or cutthroat trout that has finished spawning.

For well-studied species such as salmon, quantitative data were used to estimate abundance levels. For many species, however, reliable quantitative data were limited. Therefore, regional and local experts were consulted to estimate relative abundance based on the preceding criteria. Reference or guide species with abundance levels corresponding to the preceding criteria were developed for each estuary in cooperation with local biologists. Other species were then placed into the appropriate categories relative to the guide species. These data represent relative abundances within a specific estuary. Relative abundance levels across West Coast estuaries **could not** be determined.

Figure 4. Example of a species/estuary data sheet: Pacific herring in the Columbia River estuary.

Pacific herring — Columbia River
Clupea pallasi — Oregon/Washington
Reviewer: Bob Emmett

Salinity Zone	Life Stage	Relative Abundance by Month J F M A M J J A S O N D	R
Tidal Fresh 0.0 - 0.5 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		1
	Eggs		1
Mixing 0.5 - 25.0 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		1
	Eggs		1
Seawater >25.0 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		1
	Eggs		1

Peak Abundance: August to October
Comments: Only known spawning area in estuary is near Hammond, Oregon

Legend:

Relative Abundance:
- = Not Present
- ..... = No Data
- = Rare
- = Common
- = Abundant
- = Highly Abundant

Data Reliability (R):
1 = Highly Certain
2 = Moderately Certain
3 = Reasonable Inference

Data Verification. Approximately three years were required to develop the 1,760 data sheets (Figure 4) and consult with regional and local experts. Each data sheet was carefully reviewed during consultations or by mail. These consultations complemented the published and unpublished literature and data sets compiled by NOAA. Ninety-one scientists at 26 institutions or agencies were consulted. The names and affiliations of these experts are listed in Appendix 4. Local experts were particularly helpful in providing estuary/species-specific information. They also provided additional references and contacts and identified additional species to be included in the ELMR data base.

Data Summaries

The information compiled for each species and estuary (1,760 data sheets) was organized into four data summaries (pp. 10 - 197). Tables 2 and 3 provide graphic presentations of the spatial and temporal distribution and relative abundance by life stage for each species and estuary. The information shown represents the usual distribution of a species in a particular estuary. Table 4 ranks the relative reliability of the information presented for each species life stage and estuary.

Spatial distribution and relative abundance. Table 2 summarizes the spatial distribution and relative abundance by life stage for each species by salinity zone in each estuary. The highest level of abundance during the year in each estuary is depicted.

Temporal distribution. Table 3 summarizes the temporal distribution of each species by month and life stage for each estuary. This information combines data over the three salinity zones, with the highest level of abundance for a particular life stage shown by month.

Presence/absence data. Although each life stage of a species is assigned one of five levels of relative abundance (not present, rare, common, abundant, or highly abundant), Tables 2 and 3 do not distinguish between rare and not present. This was done because management of estuarine fisheries often does not direct efforts towards rare species. To distinguish between "not present" and "rare," Table 5 presents information on the presence/absence of species/life stages by salinity zone. If a life stage of a species was known to occur in an estuary, it was considered present.

Data Content and Quality

An important aspect of this study, especially since it was based primarily on published and unpublished literature and consultations, was to determine the quality of the data used. A deliberate effort was made to assess the overall reliability of the data base so that the information could be used appropriately. Depending upon the questions addressed, some data may not be suitable to use. Estimates of the reliability of the distribution and abundance information organized by species, life stage, and estuary are presented in Table 4 of the Data Summary Tables section. The following criteria were used to assess data reliability:

Highly certain: Considerable sampling data available. Distribution, ecology, and preferred habitats well documented within an estuary.

Moderately certain: Some sampling data available for an estuary. Distribution, preferred habitats, and ecology well documented in similar estuaries.

Reasonable inference: Little or no sampling data available. Information on species distributions, ecology, and preferred habitats documented in similar estuaries.

The quality and quantity of available data vary by species and by estuary. For example, a large amount of information is available on salmonids because they are economically valuable. In general, the lowest quality of data and the least amount available are for spawning, egg, and larval stages. Except for a few species (e.g., salmonids), very little research has focused on habitat preferences and environmental tolerances of species. This is particularly true for the small forage and/or non-commercial fishes and invertebrates. Gear selectivity, difficulty in correctly identifying larval stages, and difficulty of sampling various habitats limit the reliability of this information.

Since the amount and quality of information vary by species, life stage, estuary, and even within an estuary, considerable scientific judgment is required to derive or infer spatial and temporal distributions from existing data and literature. Unfortunately, even the most informed judgment is far from perfect due to the complexity of estuarine systems. Consequently, information on the level of certainty associated with each data element must be presented (Table 4). Appendices 3, 4, and 5 provide a complete summary of the references and personal communications used so that readers can track and obtain additional information efficiently.

Variability in Space and Time. Species data were organized according to the salinity zone boundaries identified in each estuary of the *National Estuarine Inventory Data Atlas* (NOAA 1985). However, these salinity zones are highly variable due to interacting factors that affect salinity, such as variations in freshwater inflow, wind, and tides. It was assumed that if the area of a particular salinity zone increases or decreases, the distribution of a mobile species in that zone will correspondingly shift. For example, if increased freshwater inflow shifts the tidal fresh zone further down the estuary, the distribution of a species confined to that zone increases accordingly. For euryhaline species, a distributional shift may or may not occur. The placement of species in a salinity zone was ultimately determined by where they have been observed or captured.

Species temporal distributions are often dependent on annual climatic conditions and water currents. Monthly distributional patterns were derived based on the consistent presence of a life stage within a particular month. If a species is present in an estuary only in unusual years (e.g., as a result of drought), it was not considered present. However, if a species is typically found, even during a restricted time period, it was considered present. Greater temporal resolution, such as on a biweekly rather than on a monthly basis, was not possible.

Abundance Data. Except for a few important commercial or recreational species, little or no quantitative information was available to determine the relative abundance of species across estuaries. Therefore, relative abundance estimates were made compared to other species within a specific estuary. For well-studied species, quantitative data were used to estimate the level of abundance within an estuary. However, in most cases the level of abundance assigned to a species was determined by asking regional and local biologists for expert opinions based on their knowledge of individual species within an estuary. This effort complemented the quantitative studies, and greatly increased the reliability of the abundance information. The relative abundance data shown in the data summaries are the best that could be synthesized from agency reports, academic studies, and expert reviews.

Use of ELMR Data

Classifying and Comparing Estuaries. Although the qualitative nature of the distributional data precluded statistical comparisons of species abundances among estuaries, comparisons can be made using data on the presence/absence of species in salinity zones. This information, combined with the spatial and temporal distribution data, is the strength of the data base. Estuaries can be loosely categorized by their physical and chemical characteristics and their associated species assemblages. The relative importance of individual estuaries to specific species may also be determined.

The species found in an estuary are sensitive indicators of both the mean and extreme environmental conditions within that estuary. Estuaries can be classified by the number of species present and by whether the fauna are primarily marine, estuarine, or freshwater. Species assemblages may correlate with physical characteristics, such as bottom substrate, vegetation, and the areal and temporal characteristics of salinity zones. The information on species presence/absence or other attributes can be used to determine the faunal similarities and differences among estuaries.

A comparison of estuaries and associated species can identify differing factors among those estuaries that might account for shifts in species distribution and relative abundance, helping to define ecological variables controlling species distribution. For example, a species may show differing salinity tolerances among estuaries, indicating that some other factors, such as temperature, competition, or predation may be regulating its distribution.

Linkages to Marine Ecosystems. Many aquatic species use estuaries for specific parts of their life cycles and spend the rest of their lives offshore. Most species fall into four general categories: 1) diadromous species, which use estuaries as migration corridors and, in some instances, nursery areas; 2) species that use estuaries for spawning, often at specific salinities; 3) species that spawn offshore near the mouths of estuaries and depend on tidal- and wind-driven currents to carry eggs, larvae, or early juveniles into estuarine nursery areas; and 4) species that enter estuaries during certain times of year to feed on abundant prey. The importance of any estuary can be determined by the intensity with which species use estuarine habitats. Importance can be measured both by the number of species present as well as the abundance of specific life stages in estuaries relative to offshore habitats. These data may assist in identifying adverse effects of estuarine environmental degradation on offshore populations.

The presence or absence of members of a set of preselected species or species with specific life history strategies can be used to rank the importance of an estuary to these species on a regional basis. For example, if a species group is defined as anadromous

fishes that are commercially important offshore, the strength of the offshore-estuarine linkage for each estuary can be established. This can be used to identify estuaries needing special attention or management. This approach may facilitate the linking of estuaries to geographically defined marine ecosystems. Data sets developed or under development in SAB'S *Living Marine Resources Program* and other NOAA programs will enable regional assessments with consistent species information from the head-of-tide in estuaries to the continental shelf. Integration of biological and physical data will significantly improve our ability to identify and define the biological linkages and physical interchanges between estuarine and shelf habitats.

Concluding Comments

This is the fourth report in an effort to "capture" the Nation's data on fishes and invertebrates in estuaries (see inside front cover). This research is one step in developing an information base to bridge the gap between site-specific estuarine problems and formulating regional management strategies. Filling this gap is more important than ever, as it becomes clear that the cumulative effects of small changes in many estuaries may have a total systematic effect throughout the Nation's estuaries and coastal ocean. Compiling and organizing fragments of estuarine information is a difficult task, but is necessary to effectively manage the Nation's estuaries. Although the knowledge available to conserve and protect estuaries continues to be limited, the ELMR data base will allow comparisons among species, groups of species, specific life stages and times of year within an estuary, or by geographic regions. When combined with other data sets, the ELMR data base will enable development and testing of ecological hypotheses and identify gaps in our knowledge of estuarine fishes and invertebrates.

Literature Cited

Darnell, R. M., R. E. Defenbaugh, and D. Moore. 1983. Northwestern Gulf shelf bio-atlas. Open File Report No. 82-04. Minerals Management Service, Gulf of Mexico OCS Regional Offfice. Metairie, LA. 438 p.

Gunter, G. 1967. Some relationships of estuaries to the fisheries of the Gulf of Mexico. *In* G. H. Lauff (editor), Estuaries, pp. 621-638. Amer. Assoc. Adv. Sci. Sp. Publ. No. 83, Washington, DC. 757 p.

Hammerschmidt, P. C. and L. W. McEachron. 1986. Trends in relative abundance of selected shellfishes along the Texas coast: January 1977 - March 1986. Tex. Parks Wildl. Dept., Coast. Fish. Branch, Mgmt. Data Ser., No. 108: 149 p.

Joseph, E. B. 1973. Analysis of a nursery ground. *In* A. L. Pacheco (editor). Proceedings of a Workshop on Egg, Larval, and Juvenile Stages of Fish in Atlantic Coast Estuaries.

Mann, K. H. 1982. Ecology of coastal waters. Univ. of California Press, Los Angeles, CA. 322 p.

McEachron, L. W., and A. W. Green. 1984. Assessment of annual relative abundance and mean length of six marine fishes in Texas coastal waters. Proc. Annu. Conf. Southeast Assoc. Fish and Wildl. Agencies 38: 506-519.

Monaco, M. E. 1986. National Estuarine Inventory: Living marine resources component, preliminary West Coast study. Ocean Assessments Division, NOS/NOAA. Rockville, MD. 33 p.

Monaco, M. E., T. E. Czapla, D. M. Nelson, and M. E. Pattillo. 1989. Distribution and Abundance of Fishes and Invertebrates in Texas Estuaries. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 107 p.

Monaco, M.E., and R.L. Emmett. 1988. The Estuarine Living Marine Resources Project: Washington State Component. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 82 p.

Monaco, M. E., R. L. Emmett, D. M. Nelson, and S. A. Hinton. 1990. Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries, Volume I: Data Summaries. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 240 p.

NOAA (National Oceanic and Atmospheric Administration). 1984. The national status and trends program for marine environmental quality: Program description (memo). Ocean Assessments Division, NOS/NOAA. Rockville, MD. 28 p.

NOAA (National Oceanic and Atmospheric Administration). 1985. National Estuarine Inventory: Data Atlas. Volume 1. Physical and Hydrologic Characteristics. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 103 p.

NOAA (National Oceanic and Atmospheric Administration). 1988. Bering, Chukchi, and Beaufort Seas Strategic Assessment: Data Atlas. Volume 1. Physical and Hydrologic Characteristics. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 135 p.

Odum, W. E., and E. J. Heald. 1975. The detritus-based food web of an estuarine mangrove community. *In* L. E. Cronin (editor). Estuarine Research. Academic Press. New York, NY. pp. 265 - 286.

Sherman, K., and L. M. Alexander (editors). 1985. Variability and management of large marine ecosystems. AAAS Selected Symposium 99. AAAS, Washington, DC. 319 p.

Weinstein, M. P. 1979. Shallow marsh habitats as primary nurseries for fishes and shellfish. Cape Fear River, North Carolina. Fish. Bull., U. S. 77: 339-357.

Williams, C. W., D. M. Nelson, M. E. Monaco, C. Iancu, L. C. Clements, L. R. Settle, and E. A. Irlandi. In press. Distribution and Abundance of Fishes and Invertebrates in Eastern Gulf of Mexico Estuaries. Strategic Assessment Branch, NOS/NOAA. Rockville, MD.

Data Summary Tables

Table 2. Spatial distribution and relative abundance

Table 3. Temporal distribution

Table 4. Data reliability

Table 5. Presence/absence of 47 species in West Coast estuaries

In each data summary table, species are listed in a phylogenetic order, as in Table 1. Estuaries are listed in a north to south order, as in Figure 3. At the beginning of each data summary is an index table showing the page location of each species and estuary within the data summary.

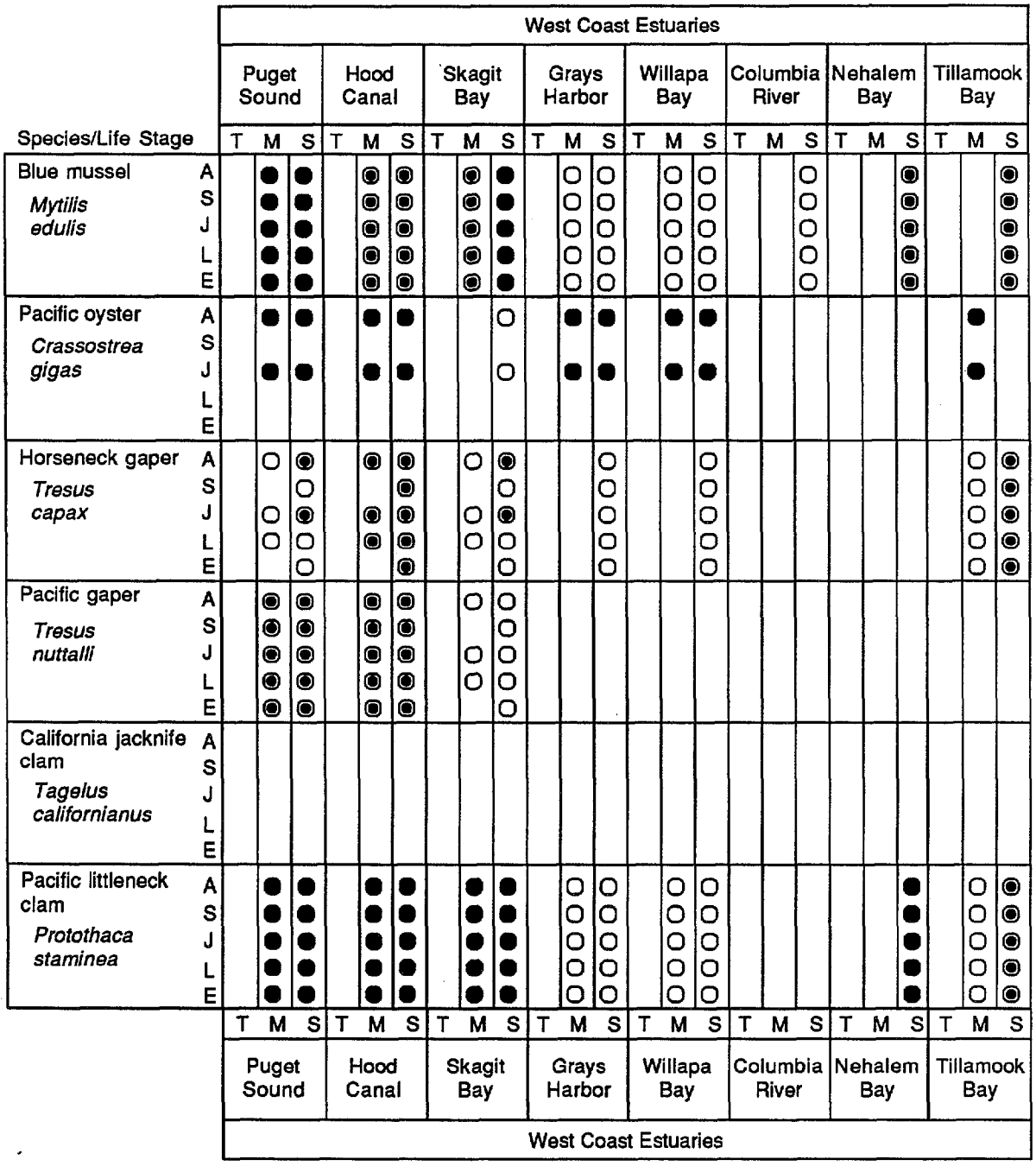
Table 2. Spatial distribution and relative abundance

Index to Table 2: Page location of spatial distribution table for each species and estuary

Common and Scientific Name	Puget Sound / Hood Canal / Skagit Bay / Grays Harbor / Willapa Bay / Columbia River / Nehalem Bay / Tillamook Bay	Netarts Bay / Siletz River / Yaquina Bay / Alsea River / Siuslaw River / Umpqua River / Coos Bay / Rogue River	Klamath River / Humboldt Bay / Eel River / Tomales Bay / Cent. S. Fran./Suisun/ San Pablo Bays / South San Fran. Bay / Elkhorn Slough / Morro Bay	Santa Monica Bay / San Pedro Bay / Alamitos Bay / Anaheim Bay / Newport Bay / Mission Bay / San Diego Bay / Tijuana Estuary
Blue mussel (*Mytilus edulis*) Pacific oyster (*Crassostrea gigas*) Horseneck gaper (*Tresus capax*) Pacific gaper (*Tresus nuttali*) California jacknife clam (*Tagelus californianus*) Pacific littleneck clam (*Protothaca staminea*)	p. 12	p. 13	p. 14	p. 15
Manila (Japanese) clam (*Venerupis japonica*) Eastern softshell clam (*Mya arenaria*) Geoduck (*Panopea abrupta*) Bay shrimp (*Crangon franciscorum*) Dungeness crab (*Cancer magister*) Leopard shark (*Triakis semifasciata*)	p. 16	p. 17	p. 18	p. 19
Green sturgeon (*Acipenser medirostris*) White sturgeon (*Acipenser transmontanus*) American shad (*Alosa sapidissima*) Pacific herring (*Clupea pallasi*) Deepbody anchovy (*Anchoa compressa*) Slough anchovy (*Anchoa delicatissima*)	p. 20	p. 21	p. 22	p. 23
Northern anchovy (*Engraulis mordax*) Cutthroat trout (*Oncorhynchus clarki*) Steelhead (*Oncorhynchus mykiss*)*	p. 24	p. 25	p. 26	p. 27
Coho salmon (*Oncorhynchus kisutch*) Chinook salmon (*Oncorhynchus tshawytscha*)*	p. 28	p. 29	p. 30	p. 31
Chum salmon (*Oncorhynchus keta*) Pink salmon (*Oncorhynchus gorbuscha*) Sockeye salmon (*Oncorhynchus nerka*) Surf smelt (*Hypomesus pretiosus*) Longfin smelt (*Spirinchus thaleichthys*)	p. 32	p. 33	p. 34	p. 35
Eulachon (*Thaleichthys pacificus*) Pacific tomcod (*Microgadus proximus*) Topsmelt (*Atherinops affinis*) Jacksmelt (*Atherinopsis californiensis*) Threespine stickleback (*Gasterosteus aculeatus*) Striped bass (*Morone saxatilis*)	p. 36	p. 37	p. 38	p. 39
Kelp bass (*Paralabrax clathratus*) Barred sand bass (*Paralabrax nebulifer*) White seabass (*Atractoscion nobilis*) White croaker (*Genyonemus lineatus*) Shiner perch (*Cymatogaster aggregata*) Pacific sand lance (*Ammodytes hexapterus*)	p. 40	p. 41	p. 42	p. 43
Arrow goby (*Clevlandia ios*) Lingcod (*Ophiodon elongatus*) Pacific staghorn sculpin (*Leptocottus armatus*) California halibut (*Paralichthys californicus*) Diamond turbot (*Hypsopsetta guttulata*) English sole (*Pleuronectes vetulus*) Starry flounder (*Platichthys stellatus*)	p. 44	p. 45	p. 46	p. 47

* Winter steelhead and summer chinook salmon are located four pages after the pages shown here.

Table 2. Data Summary Table: Spatial Distribution and Relative Abundance



Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Data Summary Table: Spatial Distribution and Relative Abundance

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Blue mussel *Mytilis edulis*	A			◉						◉						◉			●			◉			
	S			◉						◉						◉			●			◉			
	J			◉						◉						◉			●			◉			
	L			◉						◉						◉			●			◉			
	E			◉						◉						◉			●			◉			
Pacific oyster *Crassostrea gigas*	A			◉					●										○		●	●			
	S																								
	J			◉					●										○		●	●			
	L																								
	E																								
Horseneck gaper *Tresus capax*	A			◉					○	◉			○			●					○	●			
	S			◉					○	◉			○			●					○	●			
	J			◉					○	◉			○			●					○	●			
	L			◉					○	◉			○			●					○	●			
	E			◉					○	◉			○			●					○	●			
Pacific gaper *Tresus nuttalli*	A			◉																					
	S			◉																					
	J			◉																					
	L			◉																					
	E			◉																					
California jacknife clam *Tagelus californianus*	A																								
	S																								
	J																								
	L																								
	E																								
Pacific littleneck clam *Protothaca staminea*	A			◉					○	○											○	●			
	S			◉					○	○											○	●			
	J			◉					○	○											○	●			
	L			◉					○	○											○	●			
	E			◉					○	○											○	●			
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Blue mussel *Mytilis edulis*	A					●	●			○			◉		◉	●		◉	●			◉			◉
	S					●	●			○			◉		◉	●		◉	●			◉			◉
	J					●	●			○			◉		◉	●		◉	●			◉			◉
	L					●	●			○			◉		◉	●		◉	●			◉			◉
	E					●	●			○			◉		◉	●		◉	●			◉			◉
Pacific oyster *Crassostrea gigas*	A					●	●						●												●
	S																								
	J					●	●						●												●
	L																								
	E																								
Horseneck gaper *Tresus capax*	A					◉	◉																		
	S					◉	◉																		
	J					◉	◉																		
	L					◉	◉																		
	E					◉	◉																		
Pacific gaper *Tresus nuttalli*	A					○	○						◉									◉			◉
	S					○	○						◉									◉			◉
	J					○	○						◉									◉			◉
	L					○	○						◉									◉			◉
	E					○	○						◉									◉			◉
California jacknife clam *Tagelus californianus*	A																								○
	S																								○
	J																								○
	L																								○
	E																								○
Pacific littleneck clam *Protothaca staminea*	A					◉	◉						◉									○			○
	S					◉	◉						◉									○			○
	J					◉	◉						◉									○			○
	L					◉	◉						◉									○			○
	E					◉	◉						◉									○			○
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Blue mussel *Mytilis edulis*	A			◉			●			◉			◉			○			◉			◉			○
	S			◉			◉			◉			◉			○			◉			◉			○
	J			◉			●			◉			◉			○			◉			◉			○
	L			◉			◉			◉			◉			○			◉			◉			○
	E			◉			◉			◉			◉			○			◉			◉			○
Pacific oyster *Crassostrea gigas*	A																								
	S																								
	J																								
	L																								
	E																								
Horseneck gaper *Tresus capax*	A																								
	S																								
	J																								
	L																								
	E																								
Pacific gaper *Tresus nuttalli*	A						◉																		
	S						◉																		
	J						◉																		
	L						◉																		
	E						◉																		
California jacknife clam *Tagelus californianus*	A			◉			◉			○			○			○			◉			◉			◉
	S			◉			◉			○			○			○			◉			◉			◉
	J			◉			◉			○			○			○			◉			◉			◉
	L			◉			◉			○			○			○			◉			◉			◉
	E			◉			◉			○			○			○			◉			◉			◉
Pacific littleneck clam *Protothaca staminea*	A			○			○			◉			◉			○									◉
	S			○			○			◉			◉			○									◉
	J			○			○			◉			◉			○									◉
	L			○			○			◉			◉			○									◉
	E			○			○			◉			◉			○									◉
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2, continued. Spatial distribution and relative abundance

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Manila clam	A		●	○		◉	○		○	○		◉	○		●	○								○	
Venerupis japonica	S		●	○		◉	○		○	○		◉	○		●	○								○	
	J		●	○		◉	○		○	○		◉	○		●	○								○	
	L		●	○		◉	○		○	○		◉	○		●	○								○	
	E		●	○		◉	○		○	○		◉	○		●	○								○	
Eastern softshell clam	A		◉	○		○	○		●	○		◉	○		◉	○		○			●			◉	○
Mya arenaria	S		◉	○		○	○		●	○		◉	○		◉	○		○			●			◉	○
	J		◉	○		○	○		●	○		◉	○		◉	○		○			●			◉	○
	L		◉	○		○	○		●	○		◉	○		◉	○		○			●			◉	○
	E		◉	○		○	○		●	○		◉	○		◉	○		○			●			◉	○
Geoduck	A		◉	◉		◉	◉			○															
Panope abrupta	S			◉			◉			○															
	J		◉	◉		◉	◉			○															
	L		◉	◉		◉	◉			○															
	E			◉			◉			○															
Bay shrimp	A		◉	◉		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉
Crangon franciscorum	S		◉	◉		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉
	J		◉	◉		○	○	○	●	◉	○	●	◉	○	●	◉	○	●	◉	○	●	◉	○	●	◉
	L		◉	◉		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉
	E		◉	◉		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉
Dungeness crab	A		◉	◉		○	○		◉	◉		○	○		○	○		○	○		○	◉		○	◉
	M			○			○			○															
Cancer magister	J		●	●		●	●		●	●		●	●		●	●		●	●		●	●		●	●
	L		○	○		○	○		○	○		○	○		○	○		○	○			●			●
	E			○			○			○															
Leopard shark	A																								
Triakis semifasciata	P																								
	J																								
	M																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating adults

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Manila clam	A			○																		○			
Venerupis japonica	S			○																		○			
	J			○																		○			
	L			○																		○			
	E			○																		○			
Eastern softshell clam	A		○	○					●	○		◉	○		●			●			●	○			
Mya arenaria	S		○	○					●	○		◉	○		●			●			●	○			
	J		○	○					●	○		◉	○		●			●			●	○			
	L		○	○					●	○		◉	○		●			●			●	○			
	E		○	○					●	○		◉	○		●			●			●	○			
Geoduck	A																								
Panope abrupta	S																								
	J																								
	L																								
	E																								
Bay shrimp	A		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉				
Crangon franciscorum	S		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉				
	J		○	○	○	●	◉	○	●	◉	○	●	◉	○	●	◉	○	●	◉	○	●	◉				
	L		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉				
	E		○	○		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉				
Dungeness crab	A		○	○		○	○		○	◉		○	◉		○	◉		○	○		○	◉		○	○	
Cancer magister	M																					○			
	J		●	●		◉	◉		●	●		●	●		●	●		●	●		●	●		◉	◉	
	L			●			◉			●			●			●			●		◉	●				
	E																					○			
Leopard shark	A																								
Triakis semifasciata	P																								
	J																								
	M																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

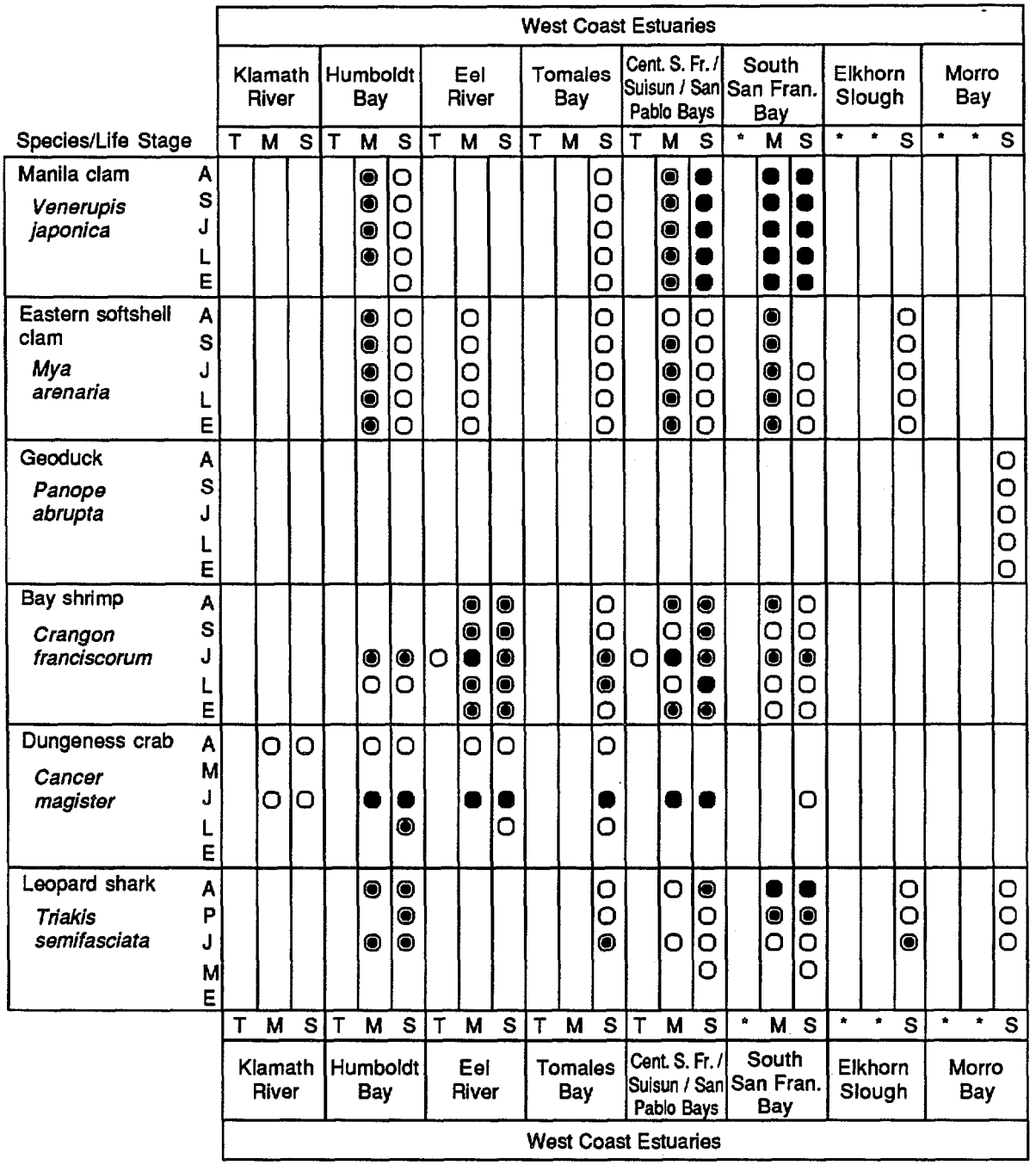
Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Table 2, continued. Spatial distribution and relative abundance.



Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Table 2, continued. Spatial distribution and relative abundance.

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Manila clam *Venerupis japonica*	A																								
	S																								
	J																								
	L																								
	E																								
Eastern softshell clam *Mya arenaria*	A																								
	S																								
	J																								
	L																								
	E																								
Geoduck *Panope abrupta*	A																								
	S																								
	J																								
	L																								
	E																								
Bay shrimp *Crangon franciscorum*	A																								
	S																								
	J																								
	L																								
	E																								
Dungeness crab *Cancer magister*	A																								
	M																								
	J																								
	L																								
	E																								
Leopard shark *Triakis semifasciata*	A			○			○																		
	P			○			○																		
	J			○			○																		
	M			○			○																		
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Table 2, continued. Spatial distribution and relative abundance (revised 1/91).

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Green sturgeon *Acipenser medirostris*	A											○	○		○	○		○	○						
	S																								
	J																								
	L																								
	E																								
White sturgeon *Acipenser transmontanus*	A										○	○	○	○	○	○	○	○	○	○	○	○			○
	S																								
	J										◉	◉	◉	◉	◉	◉	◉	◉	○	○	○	○			○
	L																								
	E																								
American shad *Alosa sapidissima*	A							○	○	○	◉	◉	◉	◉	◉	◉	◉	◉	◉						
	S																○								
	J							○	○	○	◉	◉	◉	◉	◉	◉	●	●	●						
	L																								
	E																								
Pacific herring *Clupea pallasi*	A		●	●		◉	◉		●	●						○		○	○		◉	◉		○	◉
	S		●	●		●	●		●	●						○		○			◉				◉
	J		●	●		●	●		●	●		◉	◉		◉	◉		●	●		◉	◉		◉	◉
	L		●	●		●	●		●	●		○	○		○	○		○	○		◉	◉		○	◉
	E		●	●		●	●		●	●						○		○			◉				◉
Deepbody anchovy *Anchoa compressa*	A																								
	S																								
	J																								
	L																								
	E																								
Slough anchovy *Anchoa delicatissima*	A																								
	S																								
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2, continued. Spatial distribution and relative abundance (revised 1/91).

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Green sturgeon	A									○								○	○		○	○	○	○	○
Acipenser medirostris	S																								
	J									○											○	○	○	○	○
	L																								
	E																								
White sturgeon	A							○	○	○							○	○	○		○	○	○	○	○
Acipenser transmontanus	S																								
	J							○	○	○											○	○	○	○	○
	L																								
	E																								
American shad	A							◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Alosa sapidissima	S																			◉					
	J							◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	●	●	●	◉	◉	◉
	L																			◉					
	E																			◉					
Pacific herring	A		◉	◉					◉	◉		○	○		○	○		◉	◉		◉	●			
Clupea pallasi	S			◉					●	●		○			○			◉			◉	●			
	J		○	◉		○	○		●	●		○	○		○	○		●	●		●	●		○	○
	L		◉	◉					◉	●		○	○		○			◉	◉		◉	●			
	E			◉					●	●		○			○			◉			◉	●			
Deepbody anchovy	A																								
Anchoa compressa	S																								
	J																								
	L																								
	E																								
Slough anchovy	A																								
Anchoa delicatissima	S																								
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Green sturgeon *Acipenser medirostris*	A	○	○	○		○	○	○	○	○					○	○		○	○						
	S																								
	J	○	○	○		○	○	○	○	○				○	○	○		○	○						
	L													○											
	E																								
White sturgeon *Acipenser transmontanus*	A													○	◉	○		○	○						
	S																								
	J	○	○	○										○	◉	○		○	○						
	L													○											
	E																								
American shad *Alosa sapidissima*	A	○	○	○				◉	◉	◉				●	●	●									
	S																								
	J	◉	◉	◉				◉	◉	◉				●	●	●		○	○						
	L																								
	E																								
Pacific herring *Clupea pallasi*	A					●	●		○	○			●			●			●			◉			○
	S					●			○				●			●			●			◉			
	J			○		●	●		◉	◉			●		○	◉		○	○			◉			○
	L					●	●		◉	◉			◉		○	◉		○	◉			◉			
	E					●			◉				●			●			●			◉			
Deepbody anchovy *Anchoa compressa*	A																								
	S																								
	J																								
	L																								
	E																								
Slough anchovy *Anchoa delicatissima*	A																								
	S																								
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																								
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Green sturgeon *Acipenser medirostris*	A																									
	S																									
	J																									
	L																									
	E																									
White sturgeon *Acipenser transmontanus*	A																									
	S																									
	J																									
	L																									
	E																									
American shad *Alosa sapidissima*	A																									
	S																									
	J																									
	L																									
	E																									
Pacific herring *Clupea pallasi*	A																									
	S																									
	J																									
	L																									
	E																									
Deepbody anchovy *Anchoa compressa*	A						○			○			◉			◉			○			◉			
	S						○			○			◉			◉			○			○			
	J						○			○			◉			◉			◉			◉			
	L									○			○			●			◉			○			
	E									○			○			●			○			○			
Slough anchovy *Anchoa delicatissima*	A									●						◉			◉			●			
	S									●						◉			◉			●			
	J									◉						◉			◉			●			
	L									◉						●			●			◉			
	E									●						●			◉			●			
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Northern anchovy *Engraulis mordax*	A		O	O			O		O	O		◉	●		●	●		●	●		O	O		O	O
	S		O	O			O		O	O															
	J		O	O			O		O	O		◉	●		●	●		●	●		●	●		●	●
	L		O	O			O		O	O		O	O		O	O		O	O		O	O		O	O
	E		O	O			O		O	O		O	O		O	O		O	O						
Cutthroat trout *Oncorhynchus clarki*	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	◉	O	O	O	O	O
	S																								
	J	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	◉	◉	◉	O	O	O
	L																								
	E																								
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	S																								
	J																								
	L																								
	E																								
Steelhead - Fall *Oncorhynchus mykiss (F)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	O	O	O	O	O	O	O	O	O							◉	◉	◉				O	O	O
	S																								
	J	O	O	O	O	O	O	O	O	O							◉	◉	◉				O	O	O
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- O Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Northern anchovy *Engraulis mordax*	A			○		○	○		○	○		○	○								◉	◉		○	○
	S																								
	J			○		○	○		◉	◉		○	○					◉	◉		●	●		●	●
	L									○			○								○	○			
	E																								
Cutthroat trout *Oncorhynchus clarki*	A	○	○	○	○	○	○	○	○	○	◉	○	○	◉	○	○	○	○	○	○	○	○	○	○	○
	S																								
	J	○	○	○	○	○	○	○	○	○	◉	◉	◉	◉	◉	◉	○	○	○	○	○	○	○	○	○
	L																								
	E																								
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○
	S																								
	J																								
	L																								
	E																								
Steelhead - Fall *Oncorhynchus mykiss (F)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A																								
	S																								
	J																						◉	◉	○
	L																								
	E																								
Steelhead - Summer *Oncorhynchus mykiss (S)*	A				○	○	○				○	○	○				○	○	○				◉	◉	○
	S																								
	J				○	○	○				○	○	○				○	○	○				◉	◉	◉
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

Species/Life Stage		West Coast Estuaries																								
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Northern anchovy *Engraulis mordax*	A		◉	◉		●	●		○	○			◉		●	●		◉	●			●			●
	S														◉	●			●						
	J		●	●		●	●		○	○			◉		●	●		◉	●			●			●
	L												○		○	●		◉	●			◉			◉
	E														◉	●		◉	●						
Cutthroat trout *Oncorhynchus clarki*	A	○	○	○				○	○	○															
	S																								
	J	○	○	○				○	○	○															
	L																								
	E																								
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	○	○	○				○	○	○															
	S																								
	J																								
	L																								
	E																								
Steelhead - Fall *Oncorhynchus mykiss (F)*	A	○	○	○																					
	S																								
	J	◉	◉	◉																					
	L																								
	E																								
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A																								
	S																								
	J	○	○	○				○	○	○															
	L																								
	E																								
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	○	○	○				○	○	○															
	S																								
	J	◉	◉	◉				○	◉	◉															
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Northern anchovy *Engraulis mordax*	A			●			●			●			○			◉						○			
	S			●			●																		
	J			●			●			●			○			◉						○			
	L			●			●			○			○			○			◉			○			◉
	E			●			●			○			○			◉						○			◉
Cutthroat trout *Oncorhynchus clarki*	A																								
	S																								
	J																								
	L																								
	E																								
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Fall *Oncorhynchus mykiss (F)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A																								
	S																								
	J																								
	L																								
	E																								
Steelhead - Summer *Oncorhynchus mykiss (S)*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																							
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	○	○	○	○	○	○	○	○	○	◉	○	○	◉	○	○	◉	◉	◉	◉	◉	◉	○	○	○
	S																								
	J	○	○	○	○	○	○	○	○	○	◉	○	○	◉	○	○	◉	◉	◉	◉	◉	◉	○	○	○
	L																								
	E																								
Coho salmon *Oncorhynchus kisutch*	A	◉	○	○	◉	○	○	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	S																								
	J	◉	○	○	◉	○	○	◉	○	○	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	L																								
	E																								
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	◉	◉	○	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	S																								
	J	◉	◉	○	◉	○	○	◉	◉	○	●	●	●	◉	◉	◉	●	●	●	◉	◉	◉	●	●	●
	L																								
	E																								
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	◉	◉	○	○	○	○	◉	◉	◉	◉	◉	◉				◉	◉	◉				○	○	○
	S																								
	J	◉	◉	○	◉	○	○	◉	◉	○	●	●	●				●	●	●				●	●	●
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Steelhead - Winter *Oncorhynchus mykiss (W)*	A				○	○	○	○	○	○	◉	◉	◉	○	○	○	○	○	○	◉	◉	◉	◉	◉	◉
	S																								
	J				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉	◉	◉	◉
	L																								
	E																								
Coho salmon *Oncorhynchus kisutch*	A	○	○	○	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	S																								
	J	○	○	○	◉	◉	◉	◉	●	●	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	L																								
	E																								
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A				◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
	S																								
	J				◉	◉	◉	●	●	●	◉	◉	◉	◉	◉	◉	●	●	●	◉	●	●	●	●	●
	L																								
	E																								
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A				○	○	○	○	○	○	○	○	○				◉	◉	◉	○	○	○	◉	◉	◉
	S																								
	J				◉	◉	◉	●	●	●	◉	◉	◉				●	●	●	◉	●	●	●	●	●
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

Species/Life Stage		West Coast Estuaries																					
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O									
	S																								
	J	◉	◉	◉	O	O	O	◉	◉	◉	O	O	O	O	O	O									
	L																								
	E																								
Coho salmon *Oncorhynchus kisutch*	A	O	O	O	O	O	O	O	O	O	O	O	O												
	S																								
	J	◉	◉	◉	O	O	O	O	O	O	O	O	O												
	L																								
	E																								
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	●	●	●	O	O	O	◉	◉	◉				◉	◉	◉									
	S																								
	J	●	●	●	O	O	O	●	●	●				●	●	◉			◉						
	L																								
	E																								
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A													O	O	O									
	S																								
	J													●	●	◉			◉						
	L																								
	E																								
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A													O	O	O									
	S																								
	J													●	●	◉			◉						
	L																								
	E																								
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	◉	◉	◉										O	O	O									
	S																								
	J	●	●	●										●	●	◉			◉						
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- O Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Steelhead - Winter *Oncorhynchus mykiss (W)*	A																								
	S																								
	J																								
	L																								
	E																								
Coho salmon *Oncorhynchus kisutch*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A																								
	S																								
	J																								
	L																								
	E																								
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- O Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Grays Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A																○	○	○						
	S																								
	J																●	●	●						
	L																								
	E																								
Chum salmon *Oncorhynchus keta*	A	●	●	◉	●	●	●	●	●	●	◉	◉	◉	●	●	●	○	○	○	○	○	○	◉	◉	◉
	S																								
	J	●	●	◉	●	●	●	●	●	●	◉	◉	◉	●	●	●	○	○	○	○	○	○	◉	◉	◉
	L																								
	E																								
Pink salmon *Oncorhynchus gorbuscha*	A	●	●	●	●	●	●	●	◉	◉															
	S																								
	J	●	●	●	◉	◉	◉	●	●	●															
	L				○																				
	E																								
Sockeye salmon *Oncorhynchus nerka*	A	◉	◉	○													○	○	○						
	S																								
	J	◉	◉	○													○	○	○						
	L																								
	E																								
Surf smelt *Hypomesus pretiosus*	A		◉	◉		◉	◉		◉	◉		○	○		○	○		○	○		◉	●		◉	●
	S		●	●		●			●	●															
	J		◉	◉		◉	◉		◉	◉		○	○		○	○		◉	◉		◉	●		◉	●
	L		◉	◉		●			●	●		○	○		○	○		○	○			○			○
	E		●	●		●			●	●															
Longfin smelt *Spirinchus thaleichthys*	A		○	○					○	○		○	○		○	○		◉	○						
	S										◉			◉			◉								
	J		○	○					○	○		◉	○		◉	○		●	○						
	L		○	○					○	○	○	●	◉	○	●	◉	○	●	◉						
	E										○			◉			◉								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Grays Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A																								
	S																								
	J																								
	L																								
	E																								
Chum salmon *Oncorhynchus keta*	A	◉	◉	◉	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○			
	S																								
	J	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○			
	L																								
	E																								
Pink salmon *Oncorhynchus gorbuscha*	A																								
	S																								
	J																								
	L																								
	E																								
Sockeye salmon *Oncorhynchus nerka*	A																								
	S																								
	J																								
	L																								
	E																								
Surf smelt *Hypomesus pretiosus*	A					◉	◉		○	○		○	○		◉	●		○	●		○	◉			
	S																								
	J		◉	●		◉	◉		●	●		●	●		◉	●		◉	●		●	●		○	◉
	L			○			○			○			○			○			○			○			○
	E																								
Longfin smelt *Spirinchus thaleichthys*	A							○	○	○										○	○	○			
	S							○												○					
	J								○	○											○	○			
	L							○												○	○	○			
	E							○												○					
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																								
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / San Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A																								
	S																								
	J																								
	L																								
	E																								
Chum salmon *Oncorhynchus keta*	A																								
	S																								
	J																								
	L																								
	E																								
Pink salmon *Oncorhynchus gorbuscha*	A																								
	S																								
	J																								
	L																								
	E																								
Sockeye salmon *Oncorhynchus nerka*	A																								
	S																								
	J																								
	L																								
	E																								
Surf smelt *Hypomesus pretiosus*	A					○	○			○			○												
	S																								
	J		○	○		◉	◉		◉	●			○												
	L					○	○		○	○			○												
	E																								
Longfin smelt *Spirinchus thaleichthys*	A			○	○	○	○	○	○	○				◉	◉	◉		○	○						
	S				○			○						◉											
	J			○		○	○		○	○				◉	●	◉		○	○						
	L				○	○	○	○	○	○				◉	●	○		○	○						
	E				○			○						◉											
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / San Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A																								
	S																								
	J																								
	L																								
	E																								
Chum salmon *Oncorhynchus keta*	A																								
	S																								
	J																								
	L																								
	E																								
Pink salmon *Oncorhynchus gorbuscha*	A																								
	S																								
	J																								
	L																								
	E																								
Sockeye salmon *Oncorhynchus nerka*	A																								
	S																								
	J																								
	L																								
	E																								
Surf smelt *Hypomesus pretiosus*	A																								
	S																								
	J																								
	L																								
	E																								
Longfin smelt *Spirinchus thaleichthys*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																							
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Eulachon *Thaleichthys pacificus*	A										O	O	O	O	O	O	◉	◉	◉						
	S																◉								
	J																								
	L										O	O	O	O	O	O	◉	◉	◉						
	E																◉								
Pacific tomcod *Microgadus proximus*	A		◉	◉		O	O		◉	◉		O	O		O	O		O	O		O	O		O	O
	S			O			O			O															
	J		◉	◉		O	O		●	●		●	◉		●	◉		●	◉		◉	◉		◉	◉
	L		O	O		O	O		O	O		O	O		O	O		O	O		O	O		O	O
	E			O			O			O															
Topsmelt *Atherinops affinis*	A																								O
	S																								
	J																								O
	L																								
	E																								
Jacksmelt *Atherinopsis californiensis*	A																								
	S																								
	J																								
	L																								
	E																								
Threespine stickleback *Gasterosteus aculeatus*	A	O	O	O	O	O	O	●	●	O	◉	◉	O	◉	◉	O	◉	◉		O	O	O	O	O	O
	S	O	O		O	O		●	O		◉	O		◉	O		◉	O		O	O		O	O	
	J	◉	◉	O	◉	O	O	●	●	O	●	◉	O	●	◉	O	●	◉		◉	O	O	O	O	O
	L	O	O		O	O		O	O		O	O		O	O		O	O		O	O		O	O	
	E	O	O		O	O		O	O		O	O		O	O		O	O		O	O		O	O	
Striped bass *Morone saxatilis*	A																								
	S																								
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- O Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Eulachon	A																○	○	○						
Thaleichthys pacificus	S																								
	J																								
	L																○	○	○						
	E																								
Pacific tomcod	A					○	○			○			○			○		○	○		○	◉		○	○
Microgadus proximus	S																								
	J		○	○		○	○		○	○		○	○		○	○		○	○		○	◉		○	○
	L			○																					
	E																								
Topsmelt	A		○	◉					◉	◉		○	○		◉	◉			○		●	●			
Atherinops affinis	S		○	◉					◉	◉		○	○		◉	◉					●	●			
	J		◉	◉					●	●		○	○		◉	◉			○		●	●			
	L		○	○					○	○		○	○		○	○					○	○			
	E		○	◉					◉	◉		○	○		○	◉					●	●			
Jacksmelt	A																					○			
Atherinopsis californiensis	S																								
	J																					○			
	L																								
	E																								
Threespine stickleback	A		◉	◉	○	○	○	○	○	○	○	○	○	◉	●	○	◉	○		○	○		○	○	○
	S		◉		○	○		○	○		○	○		○	○		◉	○		○	○		○	○	
Gasterosteus aculeatus	J		●	●	○	○	○	◉	○	○	◉	○	○	◉	◉	○	●	●		◉	○		○	○	○
	L		◉		○	○		○	○		○	○		○	○		○	○		○	○		○	○	
	E		◉		○	○		○	○		○	○		○	○		◉	○		○	○		○	○	
Striped bass	A													○			○	○	○	○	○				
Morone saxatilis	S													○			○			○					
	J													○			○			○	○				
	L													○			○			○					
	E													○			○			○					
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																								
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Eulachon	A	◉	◉	◉																					
Thaleichthys pacificus	S																								
	J																								
	L	○	○	○																					
	E	○																							
Pacific tomcod	A					○	○						○												
Microgadus proximus	S																								
	J					○	○						○												
	L																								
	E																								
Topsmelt	A					○	○		○	○			◉		○	○		○	◉			●			●
Atherinops affinis	S					○	○		○	○			◉						●			●			●
	J					○	○		○	○			●		○	○		◉	●			●			●
	L					○	○		○	○			◉			○		○	◉			◉			◉
	E					○	○		○	○			◉						●			●			●
Jacksmelt	A					○	○						●		◉	●		●	●			◉			◉
Atherinopsis californiensis	S					○	○						●		◉	●		◉	●			◉			◉
	J					○	○						●		○	●		◉	●			○			○
	L					○	○						●		○	●		●	●			◉			○
	E					○	○						●		○	●		◉	●			◉			◉
Threespine stickleback	A	◉	◉	◉	●	●	○	◉	◉	○			○	●	◉	○		◉	○			○			○
	S	◉	◉		●	●		○	○				○	◉	○			○							
Gasterosteus aculeatus	J	◉	◉	◉	●	●	○	◉	◉	○			○	●	◉	○		◉	○			○			○
	L	◉	◉		○	○		○	○				○	◉	○			○							
	E	◉	◉		○	○		○	○				○	◉	○			○							
Striped bass	A												○	◉	◉	◉		○	◉						
Morone saxatilis	S													○											
	J													◉	◉	○		○	○						
	L													◉	○										
	E													○	○										
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																											
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Eulachon *Thaleichthys pacificus*	A																								
	S																								
	J																								
	L																								
	E																								
Pacific tomcod *Microgadus proximus*	A																								
	S																								
	J																								
	L																								
	E																								
Topsmelt *Atherinops affinis*	A			◉			◉			◉			◉			◉			◉			◉			●
	S			○			○			◉			◉			◉			◉			◉			●
	J			◉			◉			●			●			●			●			●			●
	L			○			○			◉			◉			○			○			○			●
	E			○			○			◉			◉			◉			◉			◉			●
Jacksmelt *Atherinopsis californiensis*	A			◉			◉												◉			○			
	S			◉			◉												◉			○			
	J			◉			◉												◉			○			
	L			○			○												◉			○			
	E			◉			◉												◉			○			
Threespine stickleback *Gasterosteus aculeatus*	A																								
	S																								
	J																								
	L																								
	E																								
Striped bass *Morone saxatilis*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																											

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Kelp bass *Paralabrax clathratus*	A																								
	S																								
	J																								
	L																								
	E																								
Barred sand bass *Paralabrax nebulifer*	A																								
	S																								
	J																								
	L																								
	E																								
White croaker *Genyonemus lineatus*	A																								
	S																								
	J																								
	L																								
	E																								
White seabass *Atractoscion nobilis*	A																								
	S																								
	J																								
	L																								
	E																								
Shiner perch *Cymatogaster aggregata*	A		●	●		●	●		●	●		◉	○		◉	○		◉	○		◉	◉		◉	◉
	P		◉			◉			◉			◉			◉			◉			◉	◉		◉	◉
	J	○	●	◉	○	●	◉	○	●	◉	○	●	○	○	●	○	○	●	○	○	●	◉	○	●	●
	L																								
	E																								
Pacific sand lance *Ammodytes hexapterus*	A		○	○		○	○		○	○			○			○		○	○		○	◉		○	◉
	S		◉	●		●	●		●	●															
	J		◉	●		●	●		●	●		○	◉		○	◉		○	○		○	◉		○	◉
	L		◉	●		●	●		●	●		○	○		○	○		○	○			○			○
	E		◉	●		●	●		●	●															
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																								
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Kelp bass *Paralabrax clathratus*	A																								
	S																								
	J																								
	L																								
	E																								
Barred sand bass *Paralabrax nebulifer*	A																								
	S																								
	J																								
	L																								
	E																								
White croaker *Genyonemus lineatus*	A																								
	S																								
	J																								
	L																								
	E																								
White seabass *Atractoscion nobilis*	A																								
	S																								
	J																								
	L																								
	E																								
Shiner perch *Cymatogaster aggregata*	A		●	●		●	●		●	●		●	●		●	●		●	●		●	●		●	●
	P		●	●		●	●		●	●		●	●		●	●		●	●		●	●		●	●
	J		●	●		●	●	○	●	●	○	●	●		●	●		●	●		●	●		●	●
	L																								
	E																								
Pacific sand lance *Ammodytes hexapterus*	A			◉			○			○			○			○			◉			○			
	S																								
	J			◉			○			○			○			○			◉			○			
	L			○			○			○			○			○			○			○			
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Kelp bass *Paralabrax clathratus*	A																								
	S																								
	J																								
	L																								
	E																								
Barred sand bass *Paralabrax nebulifer*	A																								
	S																								
	J																								
	L																								
	E																								
White croaker *Genyonemus lineatus*	A						○						○			○		○	○						
	S												○			○			○						
	J						○						○		○	○		○	○						
	L												○		○	○		○	○			◉			
	E												○			○			○						
White seabass *Atractoscion nobilis*	A																								
	S																								
	J																								
	L																								
	E																								
Shiner perch *Cymatogaster aggregata*	A		◉	◉		●	●		●	◉			◉		◉	◉		●	◉			●			●
	P		◉	◉		●	●		●	◉			◉		◉	◉		◉	◉			◉			◉
	J		◉	◉		●	●		●	◉			●		●	●		●	●			●			●
	L																								
	E																								
Pacific sand lance *Ammodytes hexapterus*	A						○						○												
	S												○												
	J						○						○												
	L						○						○												
	E												○												
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Kelp bass *Paralabrax clathratus*	A			◉			◉												O						
	S			O			O																		
	J			◉			◉												O						
	L			O			O												O						
	E			O			O																		
Barred sand bass *Paralabrax nebulifer*	A			◉			◉			O			O			O			◉			O			
	S			O			O																		
	J			◉			◉			O			O			O			◉			◉			
	L			O			O												O			O			
	E			O			O																		
White croaker *Genyonemus lineatus*	A			●			●			O			O									O			
	S			●			●																		
	J			●			●			◉			O			O						O			
	L			●			●			O			O			O			O						O
	E			●			●																		
White seabass *Atractoscion nobilis*	A			O			O																		
	S			O			O																		
	J			O			O																		
	L																								
	E			O			O																		
Shiner perch *Cymatogaster aggregata*	A			O			O			O			O			O			◉			◉			
	P			O			O			O			O			O			◉			◉			
	J			O			O			◉			◉			◉			●			●			
	L																								
	E																								
Pacific sand lance *Ammodytes hexapterus*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- O Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Arrow goby *Clevelandia ios*	A		○	○		○	○		○	○		○	○		○	○								
	S		○	○		○	○		○	○		○	○		○	○								
	J		○	○		○	○		○	○		○	○		○	○								
	L		○	○		○	○		○	○		○	○		○	○								
	E		○	○		○	○		○	○		○	○		○	○								
Lingcod *Ophiodon elongatus*	A			○			○			○														
	S			○			○			○														
	J		○	○		○	○		○	○		○	○		○	○						○			○
	L		○	○		○	○		○	○		○	○		○	○								
	E			○			○			○														
Pacific staghorn sculpin *Leptocottus armatus*	A		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉	○	◉	○		◉	◉		◉	◉
	S			○			○			○			○			○			○						○
	J	○	◉	◉	○	◉	◉	○	◉	◉	○	◉	◉	○	◉	◉	○	◉	◉	○	◉	◉	○	◉	◉
	L		○	○		○	○		○	○			○			○		○	○			○			○
	E			○			○			○			○			○			○						○
California halibut *Paralichthys californicus*	A																								
	S																								
	J																								
	L																								
	E																								
Diamond turbot *Hypsopsetta guttulata*	A																								
	S																								
	J																								
	L																								
	E																								
English sole *Pleuronectes vetulus*	A			◉			◉			◉															
	S			◉			◉			◉															
	J		●	●		●	●		◉	◉		◉	◉		◉	◉		◉	○		○	◉		●	●
	L		●	●		●	●		○	◉		○	○		○	○		○	○			○		○	○
	E			●			●			●															
Starry flounder *Platichthys stellatus*	A		○	◉		○	◉		○	◉		○	○		○	○		○	○		○	○		○	○
	S			◉			◉			◉															
	J	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○
	L		○	○		○	○		○	◉		○	○		○	○		○			○	○		○	○
	E			○			○			○															
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Gray's Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2, continued. Spatial distribution and relative abundance (revised 1/91).

Species/Life Stage		West Coast Estuaries																								
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Arrow goby *Clevelandia ios*	A								○												○	○			
	S								○												○	○			
	J								○												○	○			
	L								○												○	○			
	E								○												○	○			
Lingcod *Ophiodon elongatus*	A									○															
	S																								
	J			○						○									○		○	○			
	L																					○			
	E																								
Pacific staghorn sculpin *Leptocottus armatus*	A		◉	◉		◉	◉		●	●		●	●		●	●		●	●		●	●		◉	◉
	S			○			○			○			○			○			○			○			○
	J	○	●	●	○	◉	◉	○	●	●	○	●	●	○	●	●		●	●	○	●	●		◉	◉
	L			○			○			○			○			○			○			○			○
	E			○			○			○			○			○			○			○			○
California halibut *Paralichthys californicus*	A																								
	S																								
	J																								
	L																								
	E																								
Diamond turbot *Hypsopsetta guttulata*	A																								
	S																								
	J																								
	L																								
	E																								
English sole *Pleuronectes vetulus*	A																								
	S																								
	J		○	◉		○	◉		◉	●		◉	●		○	◉		○	◉		◉	◉			
	L			○			○			○						○			○			○			
	E																								
Starry flounder *Platichthys stellatus*	A					○	○		○	○		○	○		○	○		○	○		○	○			
	S																								
	J		○	○	◉	◉	○	◉	◉	○	◉	◉	○	○	○	○	◉	◉	○	◉	◉	○	◉	◉	○
	L		○	○		○	○		○	○			○			○			○			○			○
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		
		West Coast Estuaries																								

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2, continued. Spatial distribution and relative abundance (revised 1/91).

Species/Life Stage		West Coast Estuaries																					
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
Arrow goby *Clevelandia ios*	A					○	○						○		○	○		○	○			◉			◉
	S					○	○						◉		○	◉		◉	◉			◉			◉
	J					○	○						◉		◉	◉		◉	◉			◉			◉
	L					○	○						◉		◉	◉		◉	◉			◉			◉
	E					○	○						◉		○	◉		◉	◉			◉			◉
Lingcod *Ophiodon elongatus*	A						○																		
	S						○																		
	J					○	○						○		○	○									
	L						○						○			○									
	E						○																		
Pacific staghorn sculpin *Leptocottus armatus*	A		◉	◉		◉	◉		○	○			◉		○	◉		◉	◉			○			○
	S			○			○			○			○			○			◉						
	J		◉	◉		◉	◉		◉	◉			●	○	◉	●		●	◉			●			●
	L			○			○			○			◉		◉	◉		◉	◉			●			◉
	E			○			○			○			○			○			◉						
California halibut *Paralichthys californicus*	A																								
	S																								
	J												○			○			○			○			○
	L												○			○			○						
	E																								
Diamond turbot *Hypsopsetta guttulata*	A																								
	S																								
	J																		○			○			○
	L												○					○	○						
	E																		○						
English sole *Pleuronectes vetulus*	A																								
	S																								
	J					●	●		○	○			◉		○	◉		◉	◉			◉			○
	L					○	○			○			○		○	○									
	E																								
Starry flounder *Platichthys stellatus*	A					○	○			○			○		○	◉			○			○			
	S																								
	J	◉	◉	◉	○	○	○	○	◉	○			◉	○	●	◉		○	○			◉			○
	L			○		○	○			○			○		○	○			○						
	E																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Cent. S. Fr. / Suisun / S. Pablo Bays			South San Fran. Bay			Elkhorn Slough			Morro Bay		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Spatial Distribution and Relative Abundance Table 2 (continued).

Species/Life Stage		West Coast Estuaries																					
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
Arrow goby *Clevelandia ios*	A						○			◉			◉			◉			●			◉			◉
	S						○			◉			◉			◉			◉			◉			◉
	J						○			◉			◉			●			●			◉			◉
	L						○			◉			◉			◉			◉			◉			◉
	E						○			◉			◉			◉			◉			◉			◉
Lingcod *Ophiodon elongatus*	A																								
	S																								
	J																								
	L																								
	E																								
Pacific staghorn sculpin *Leptocottus armatus*	A									○			○									○			○
	S									○			○												
	J									◉			◉						◉			◉			○
	L									○			○						○			○			○
	E									○			○												
California halibut *Paralichthys californicus*	A			◉			○						○						○			○			○
	S			○			○																		
	J			◉			◉			◉			◉			○			◉			◉			◉
	L			◉			◉																		
	E			○			○																		
Diamond turbot *Hypsopsetta guttulata*	A			○			○			◉			◉			◉			○			○			
	S			○			○																		
	J						○			◉			◉			◉			◉			◉			○
	L			○			○			○			○						○			◉			
	E			○			○												○			◉			
English sole *Pleuronectes vetulus*	A			○			○																		
	S			○																					
	J			○																					
	L			○																					
	E			○																					
Starry flounder *Platichthys stellatus*	A																								
	S																								
	J																								
	L																								
	E																								
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary		
		West Coast Estuaries																							

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- Blank Not Present, Rare, or No Data Available

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present.

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

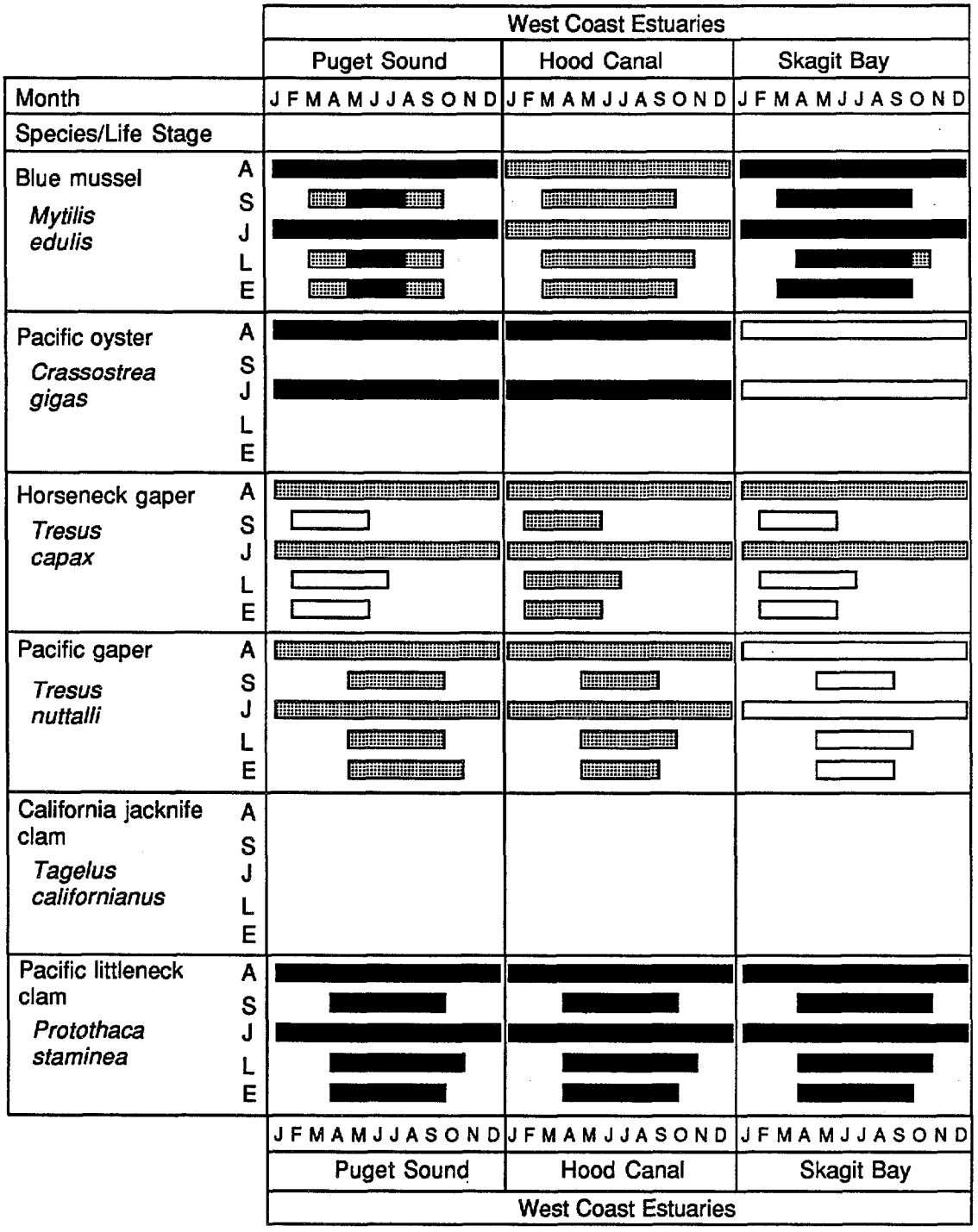
Table 3. Temporal Distribution

Index to Table 3: Page location of temporal distribution table for each species and estuary:

Common and Scientific Name	Puget Sound	Hood Canal	Skagit Bay	Grays Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay	Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River	Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fran./Suisun/ San Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay	Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Blue mussel (*Mytilus edulis*) Pacific oyster (*Crassostrea gigas*) Horseneck gaper (*Tresus capax*) Pacific gaper (*Tresus nuttalli*) California jacknife clam (*Tagelus californianus*) Pacific littleneck clam (*Protothaca staminea*)	p.49	p.50	p.51	p.52	p.53	p.54	p.55	p.56	p.57	p.58	p.59																				
Manila (Japanese) clam (*Venerupis japonica*) Eastern softshell clam (*Mya arenaria*) Geoduck (*Panope abrupta*) Bay shrimp (*Crangon franciscorum*) Dungeness crab (*Cancer magister*) Leopard shark (*Triakis semifasciata*)	p.60	p.61	p.62	p.63	p.64	p.65	p.66	p.67	p.68	p.69	p.70																				
Green sturgeon (*Acipenser medirostris*) White sturgeon (*Acipenser transmontanus*) American shad (*Alosa sapidissima*) Pacific herring (*Clupea pallasi*) Deepbody anchovy (*Anchoa compressa*) Slough anchovy (*Anchoa delicatissima*)	p.71	p.72	p.73	p.74	p.75	p.76	p.77	p.78	p.79	p.80	p.81																				
Northern anchovy (*Engraulis mordax*) Cutthroat trout (*Oncorhynchus clarki*) Steelhead (*Oncorhynchus mykiss*)*	p.82	p.83	p.84	p.85	p.86	p.87	p.88	p.89	p.90	p.91	p.92																				
Coho salmon (*Oncorhynchus kisutch*) Chinook salmon (*Oncorhynchus tshawytscha*)*	p.93	p.94	p.95	p.96	p.97	p.98	p.99	p.100	p.101	p.102	103																				
Chum salmon (*Oncorhynchus keta*) Pink salmon (*Oncorhynchus gorbuscha*) Sockeye salmon (*Oncorhynchus nerka*) Surf smelt (*Hypomesus pretiosus*) Longfin smelt (*Spirinchus thaleichthys*)	p.104	p.105	p.106	p.107	p.108	p.109	p.110	p.111	p.112	p.113	114																				
Eulachon (*Thaleichthys pacificus*) Pacific tomcod (*Microgadus proximus*) Topsmelt (*Atherinops affinis*) Jacksmelt (*Atherinopsis californiensis*) Threespine stickleback (*Gasterosteus aculeatus*) Striped bass (*Morone saxatilis*)	p.115	p.116	p.117	p.118	p.119	p.120	p.121	p.122	p.123	p.124	125																				
Kelp bass (*Paralabrax clathratus*) Barred sand bass (*Paralabrax nebulifer*) White seabass (*Atractoscion nobilis*) White croaker (*Genyonemus lineatus*) Shiner perch (*Cymatogaster aggregata*) Pacific sand lance (*Ammodytes hexapterus*)	p.126	p.127	p.128	p.129	p.130	p.131	p.132	p.133	p.134	p.135	136																				
Arrow goby (*Clevlandia ios*) Lingcod (*Ophiodon elongatus*) Pacific staghorn sculpin (*Leptocottus armatus*) California halibut (*Paralichthys californicus*) Diamond turbot (*Hypsopsetta guttulata*) English sole (*Pleuronectes vetulus*) Starry flounder (*Platichthys stellatus*)	p.137	p.138	p.139	p.140	p.141	p.142	p.143	p.144	p.145	p.146	147																				

* Winter steelhead and summer chinook salmon are located eleven pages after the pages shown here.

Table 3. Data Summary Table: Temporal Distribution



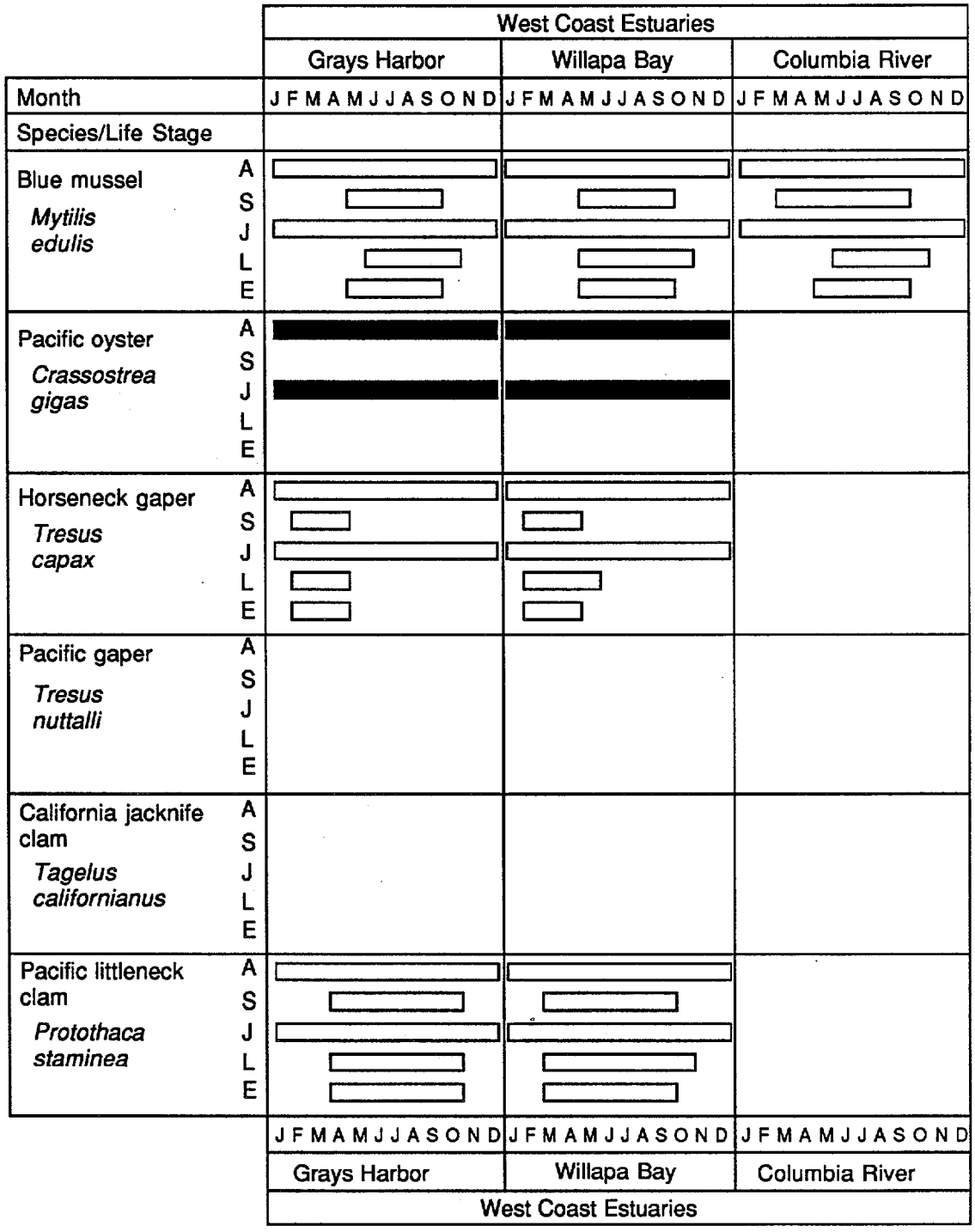
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Data Summary Table: Temporal Distribution



Relative Abundance

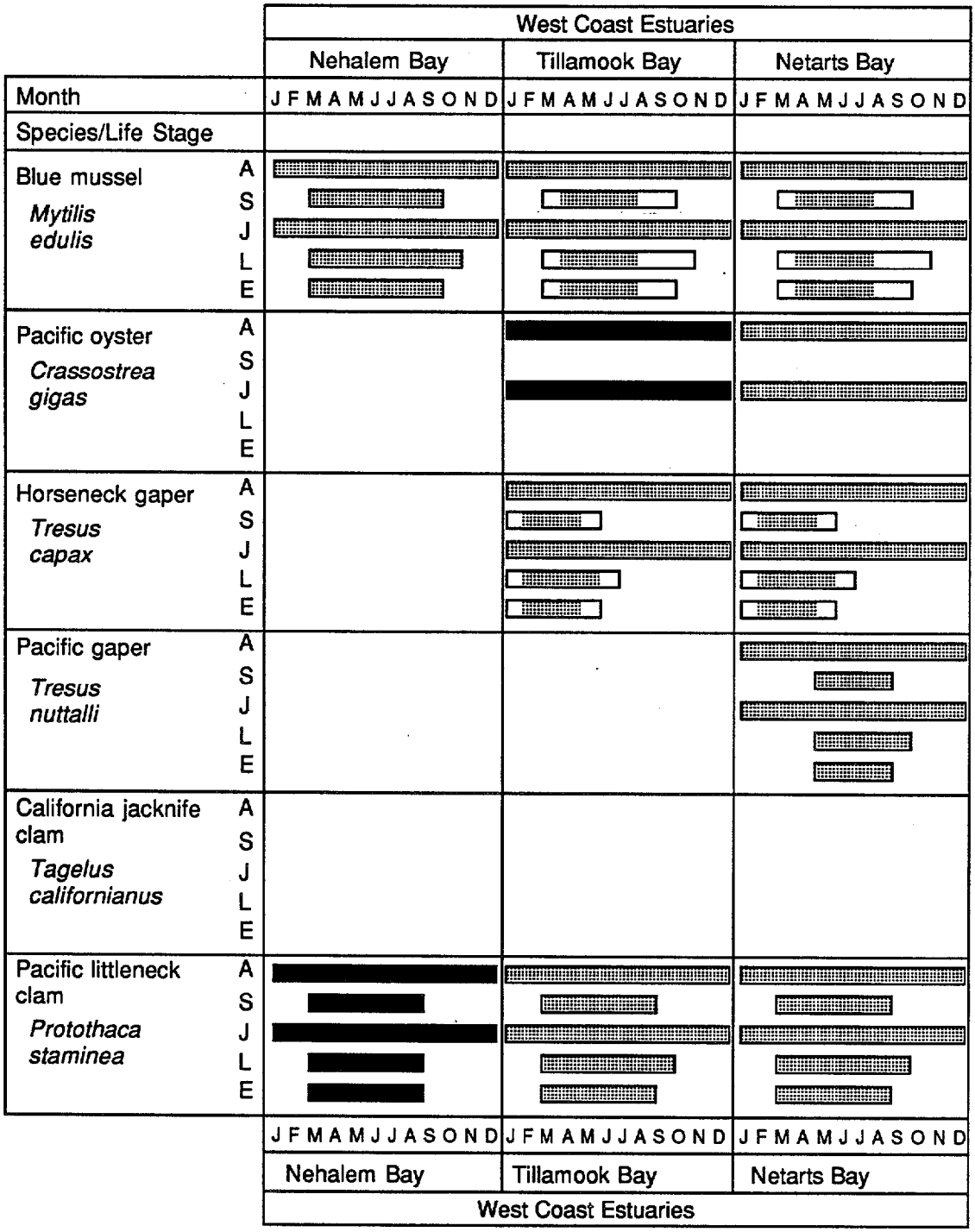
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

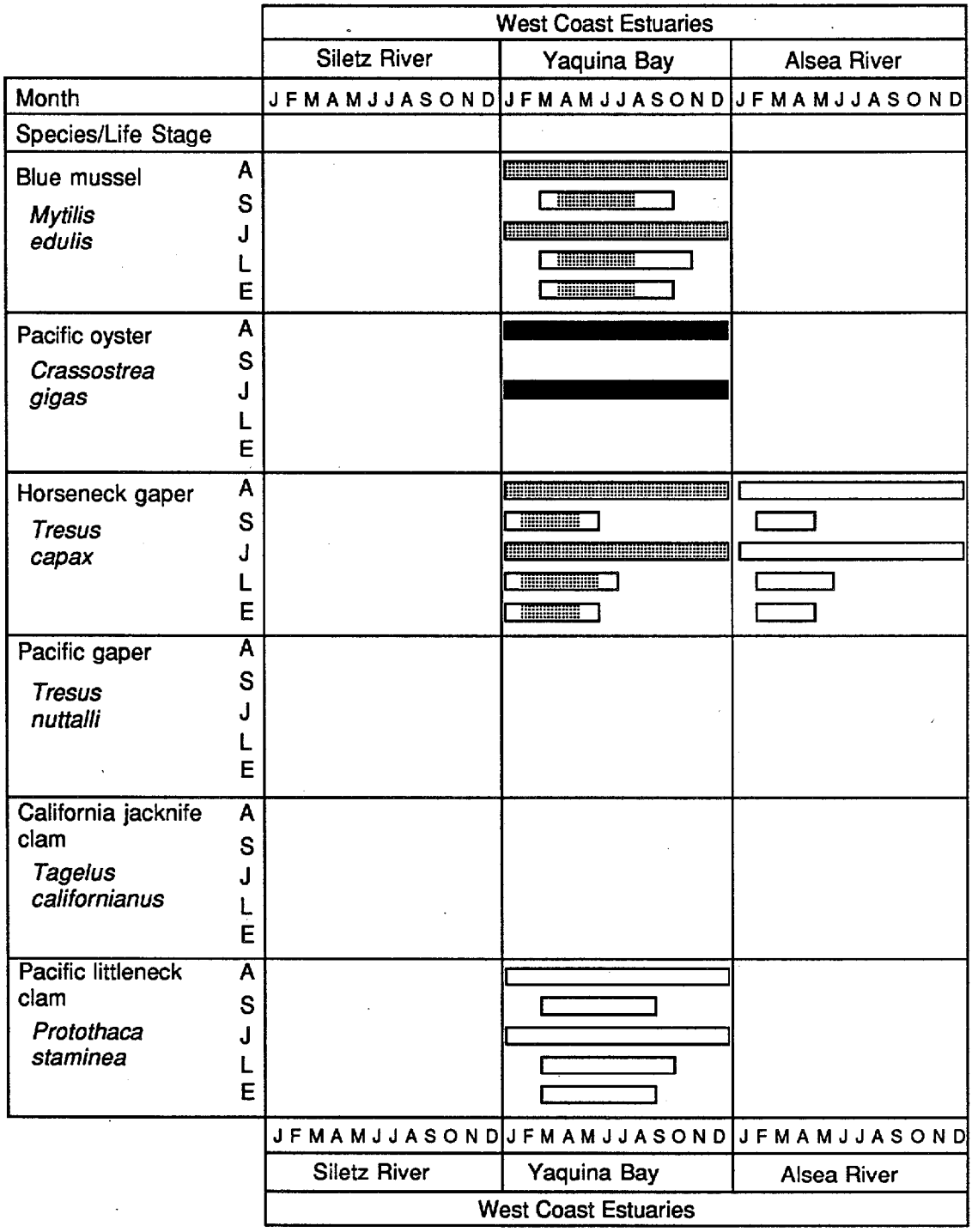
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

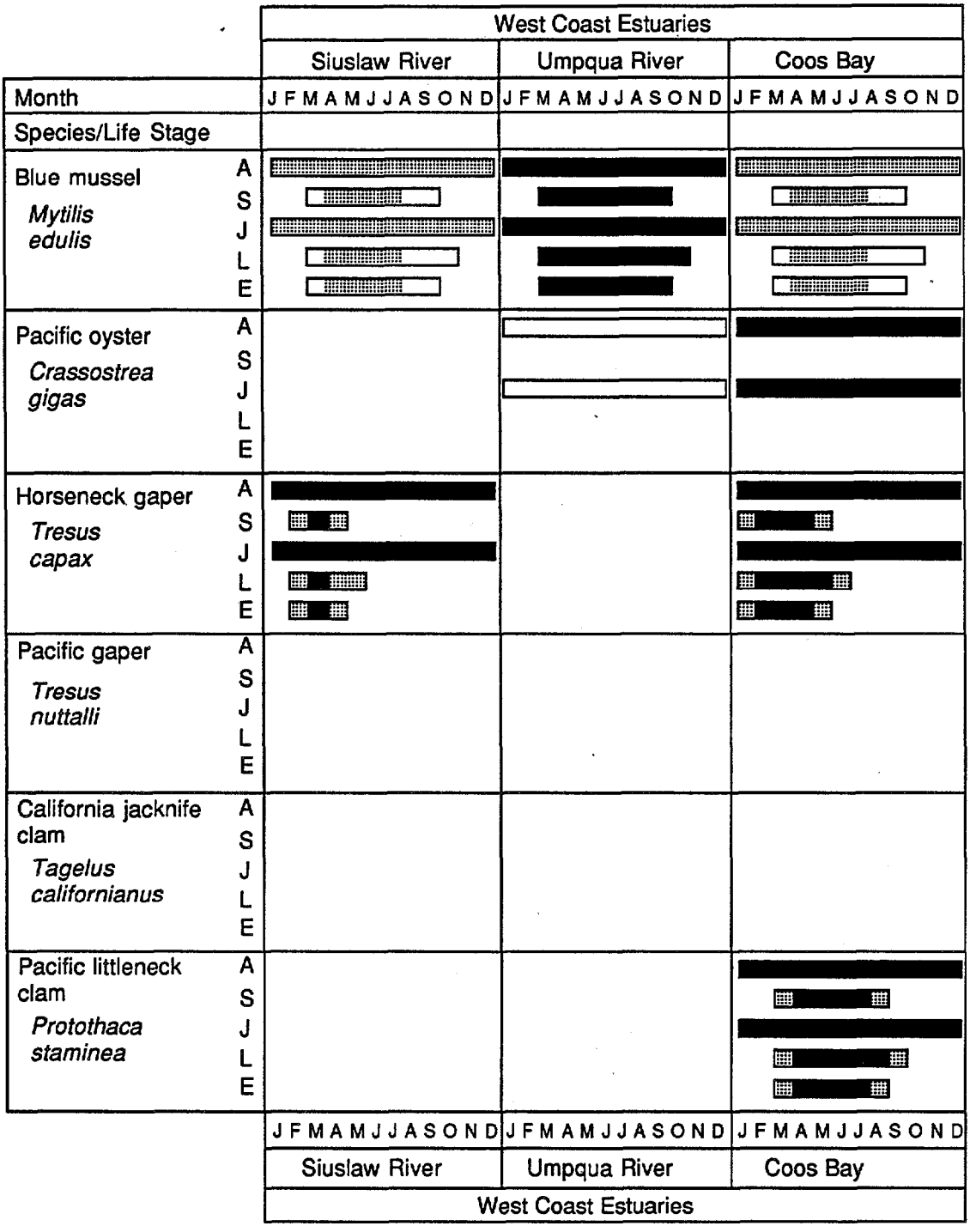
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

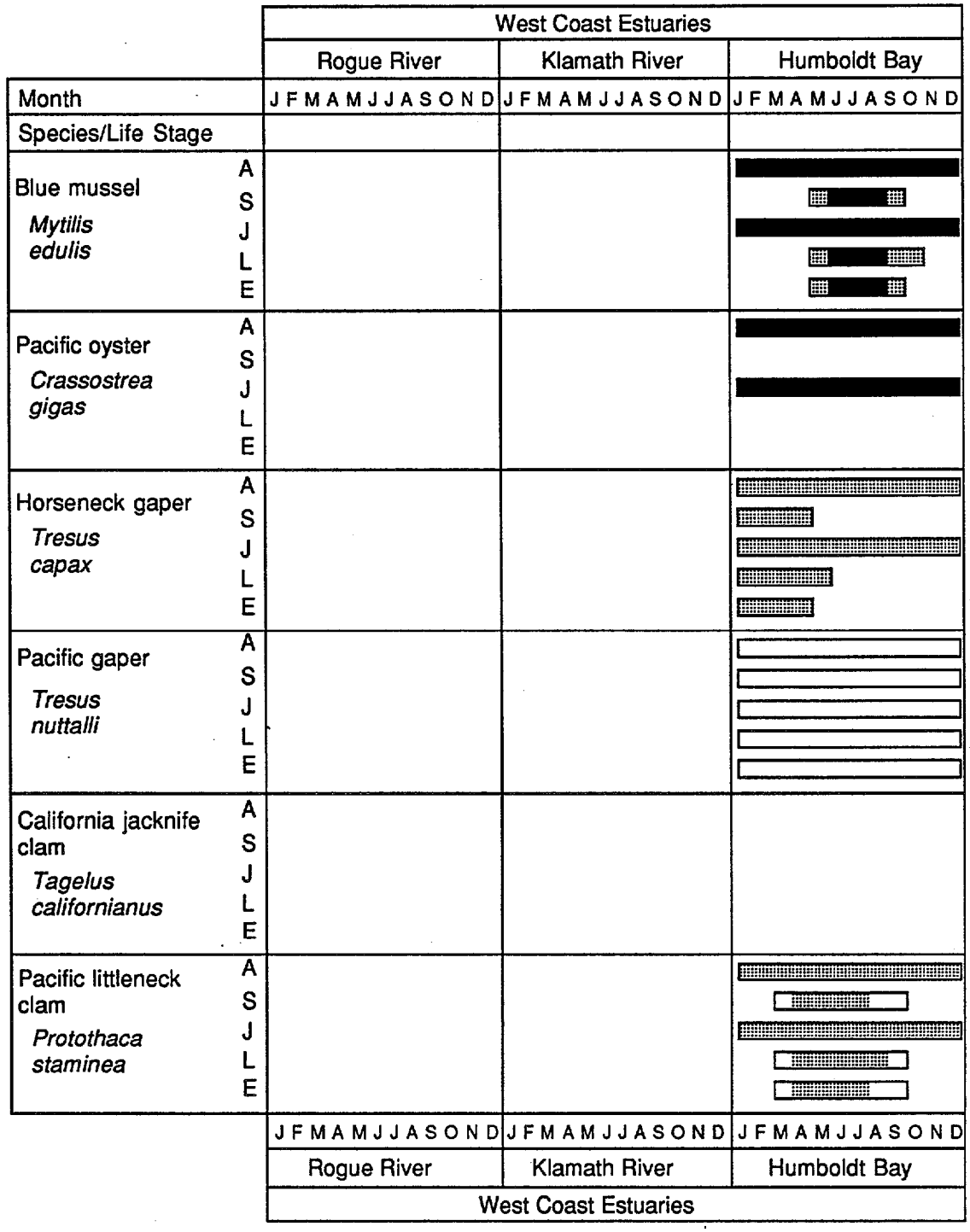
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

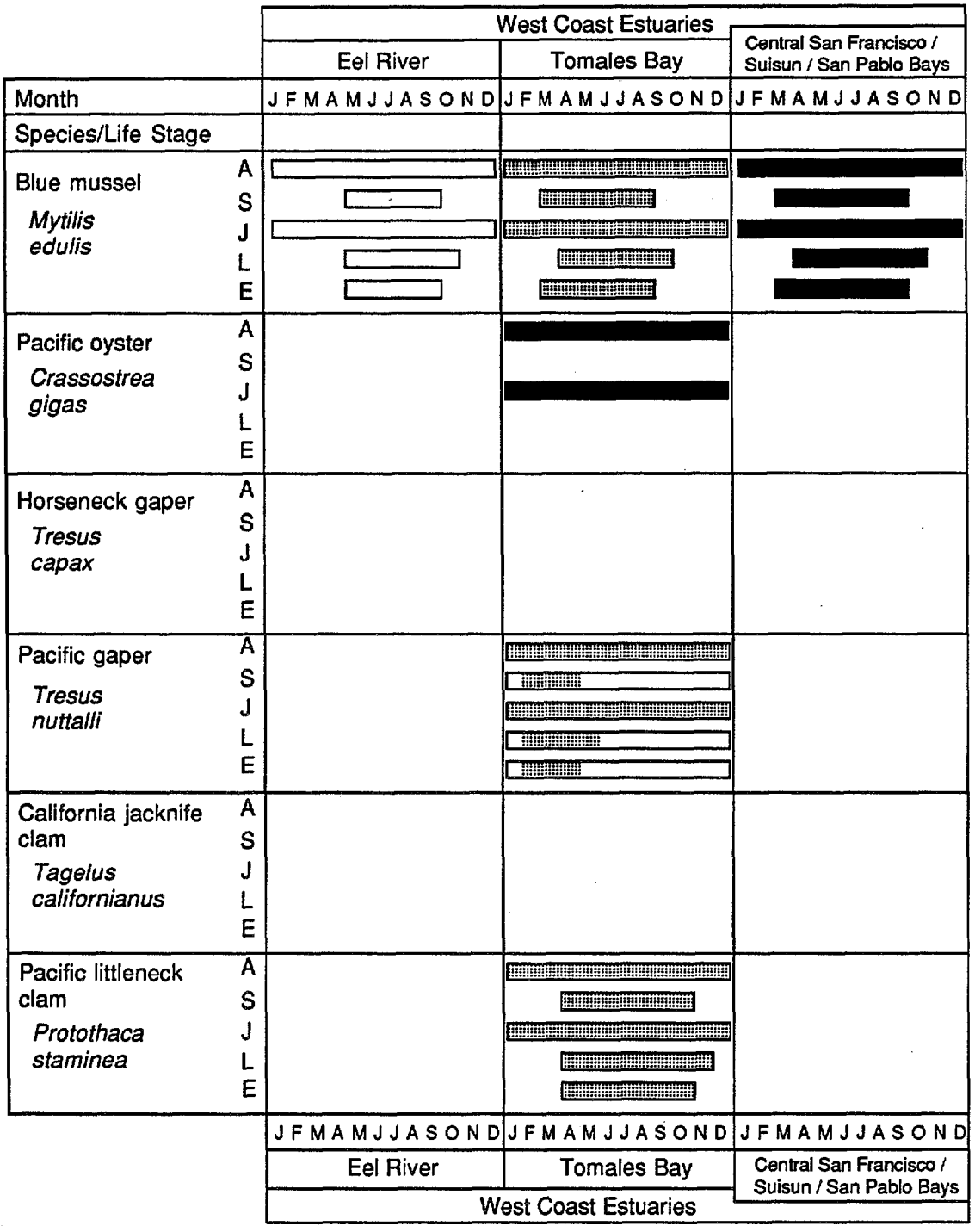
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

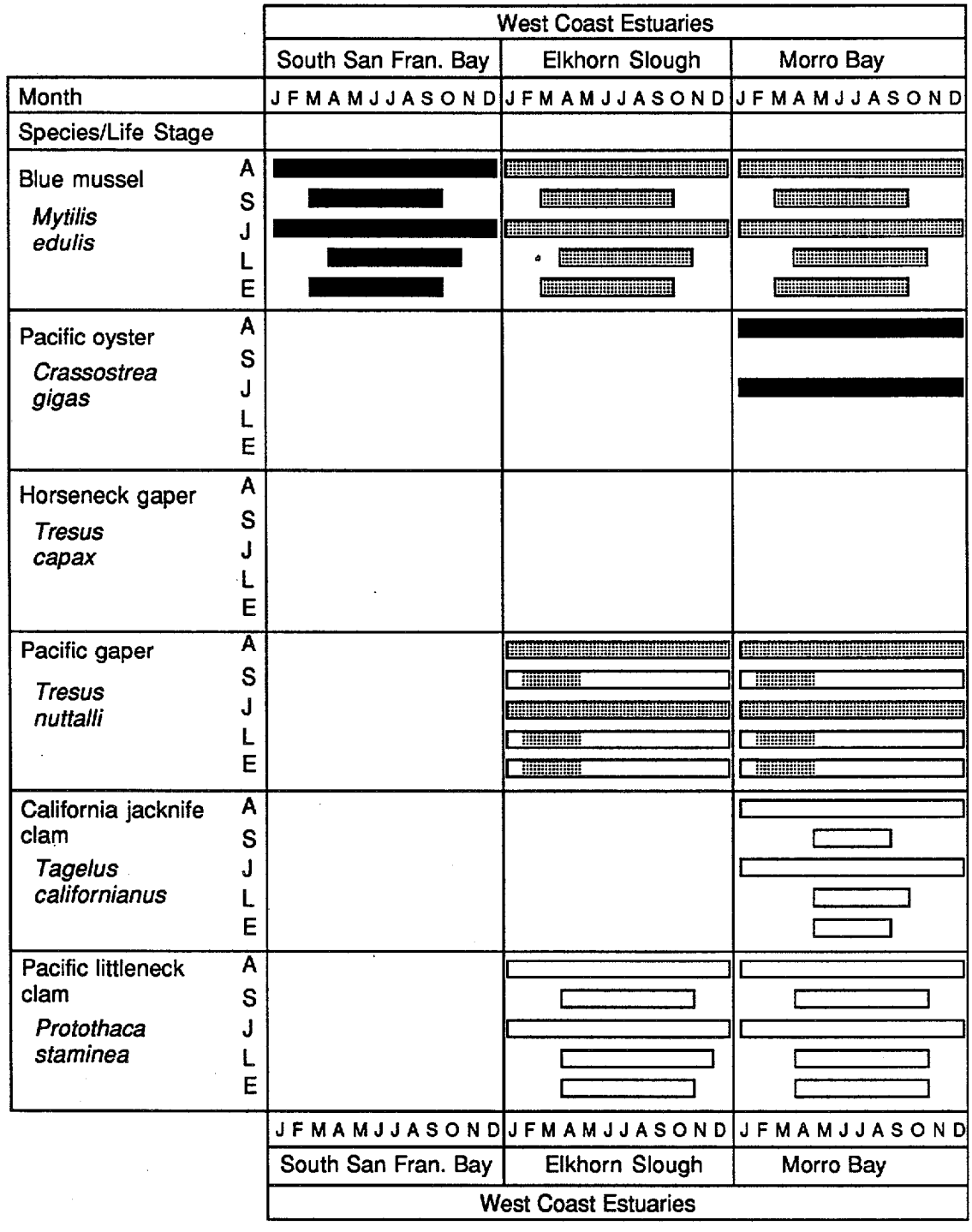
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

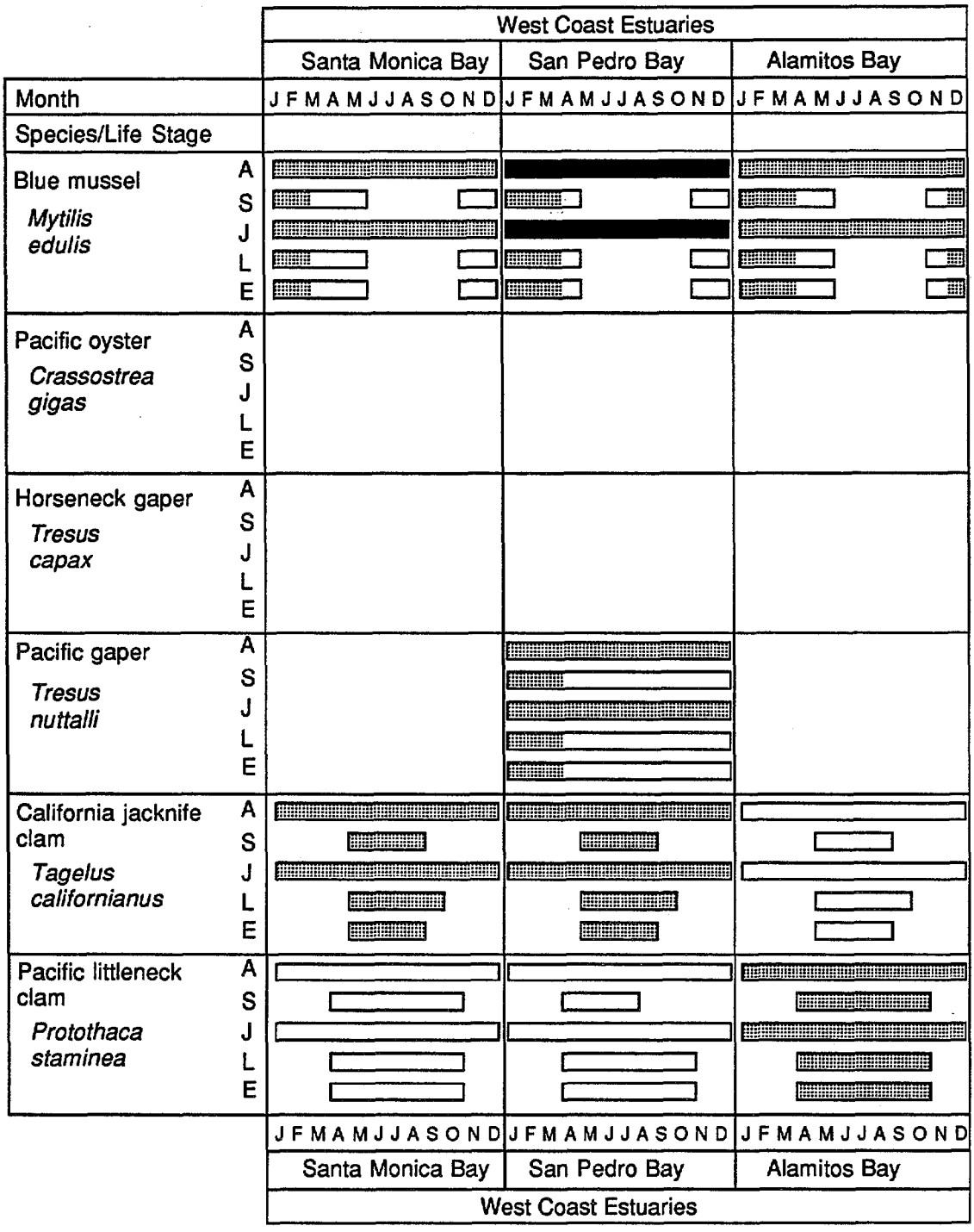
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

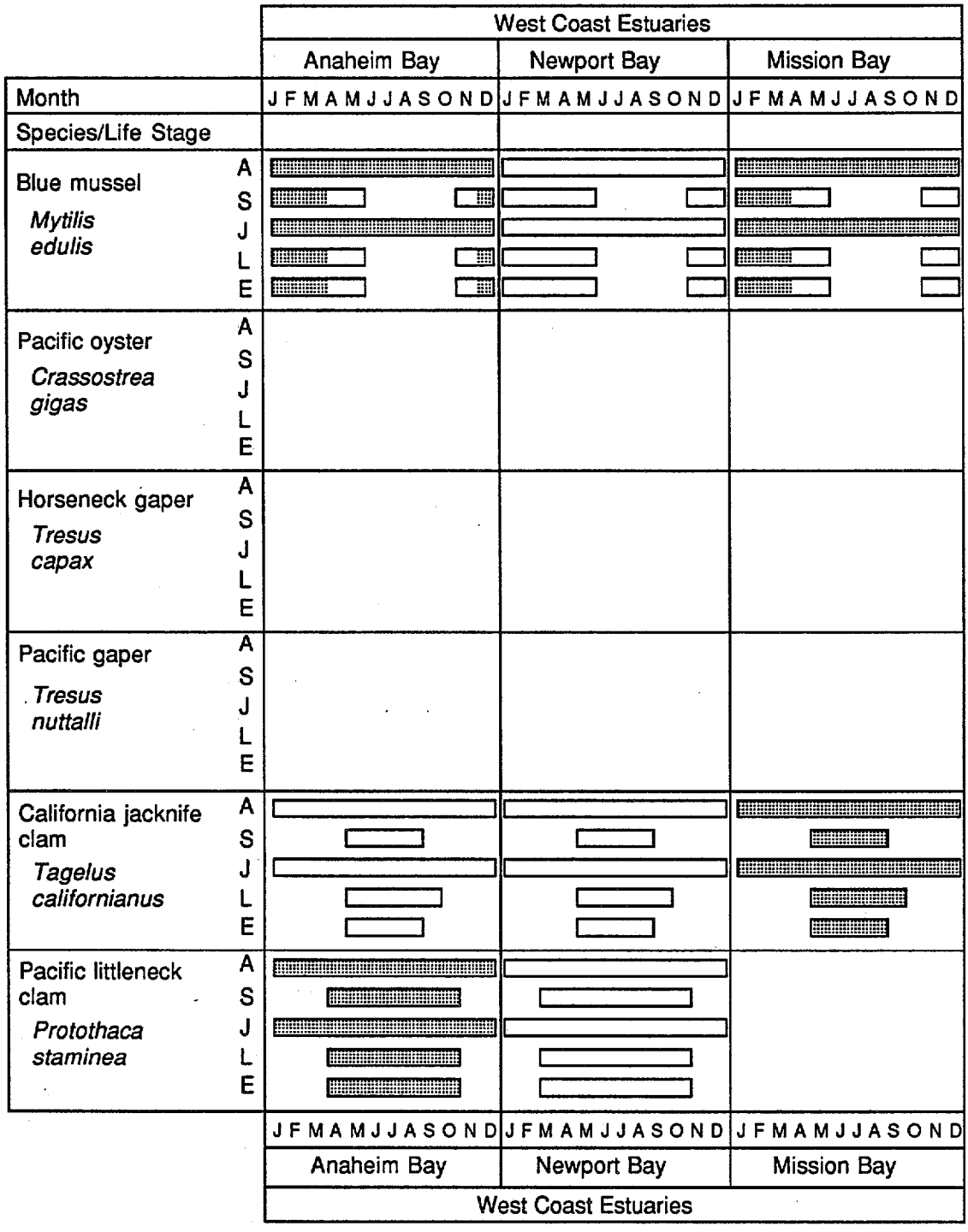
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

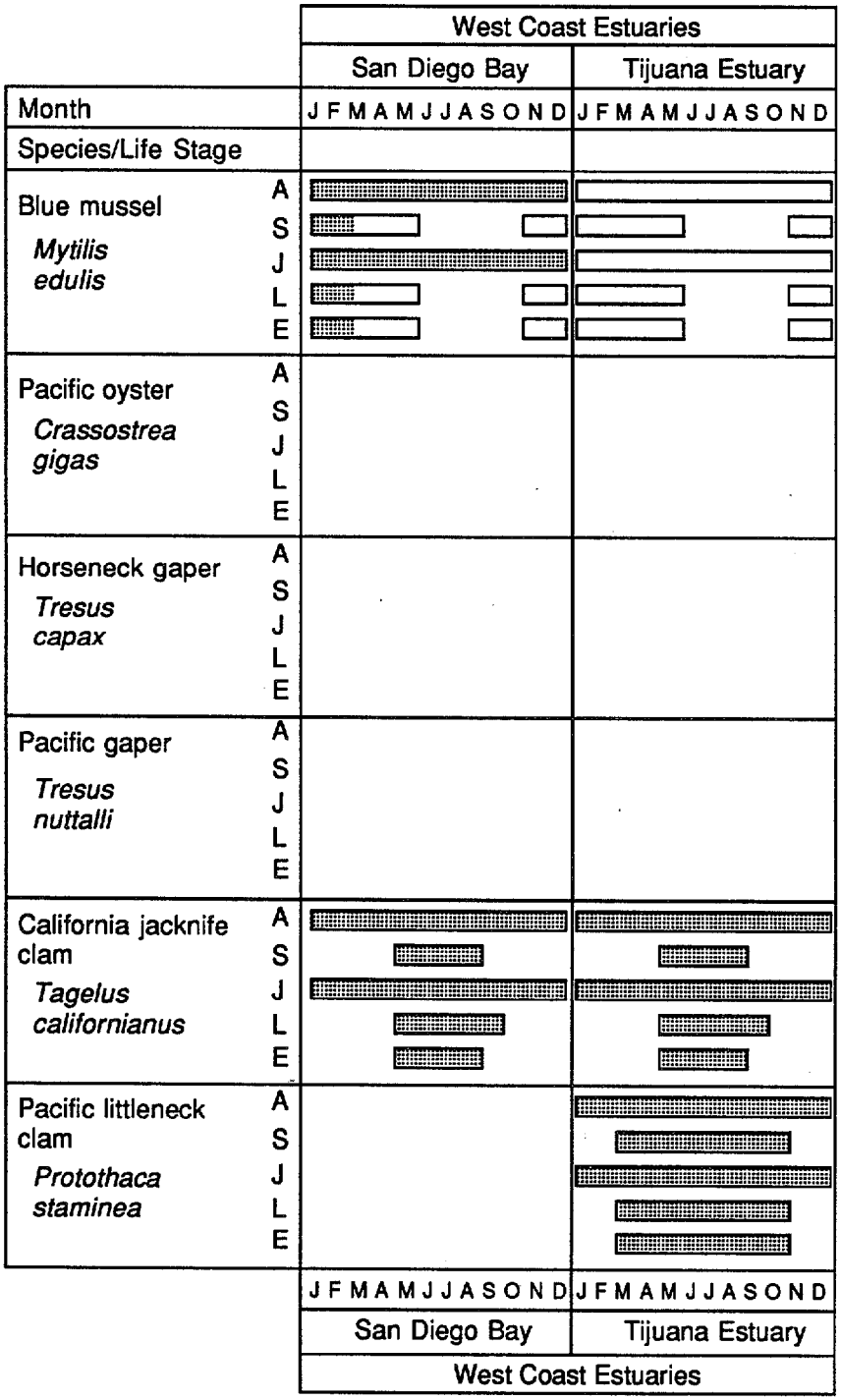
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

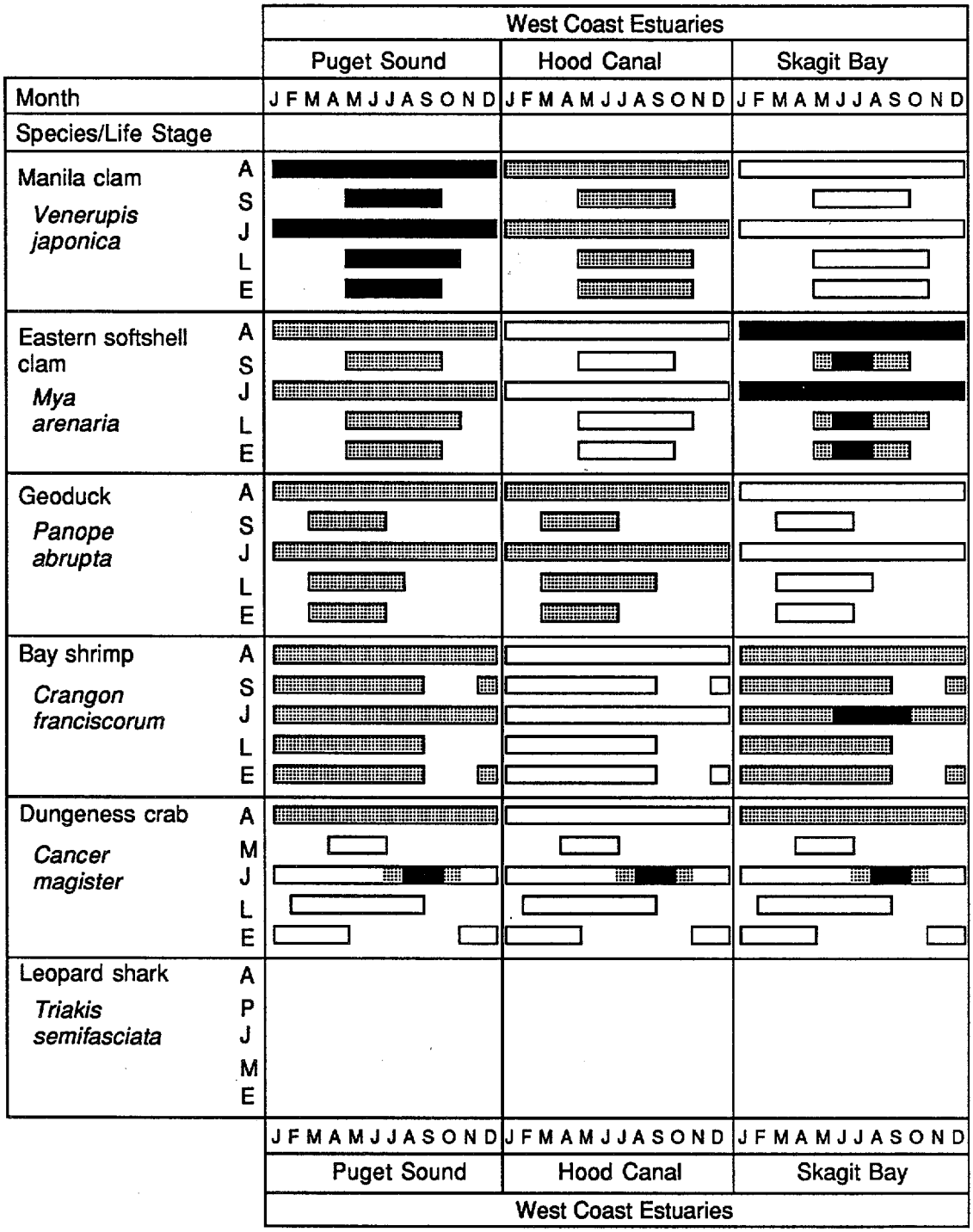
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

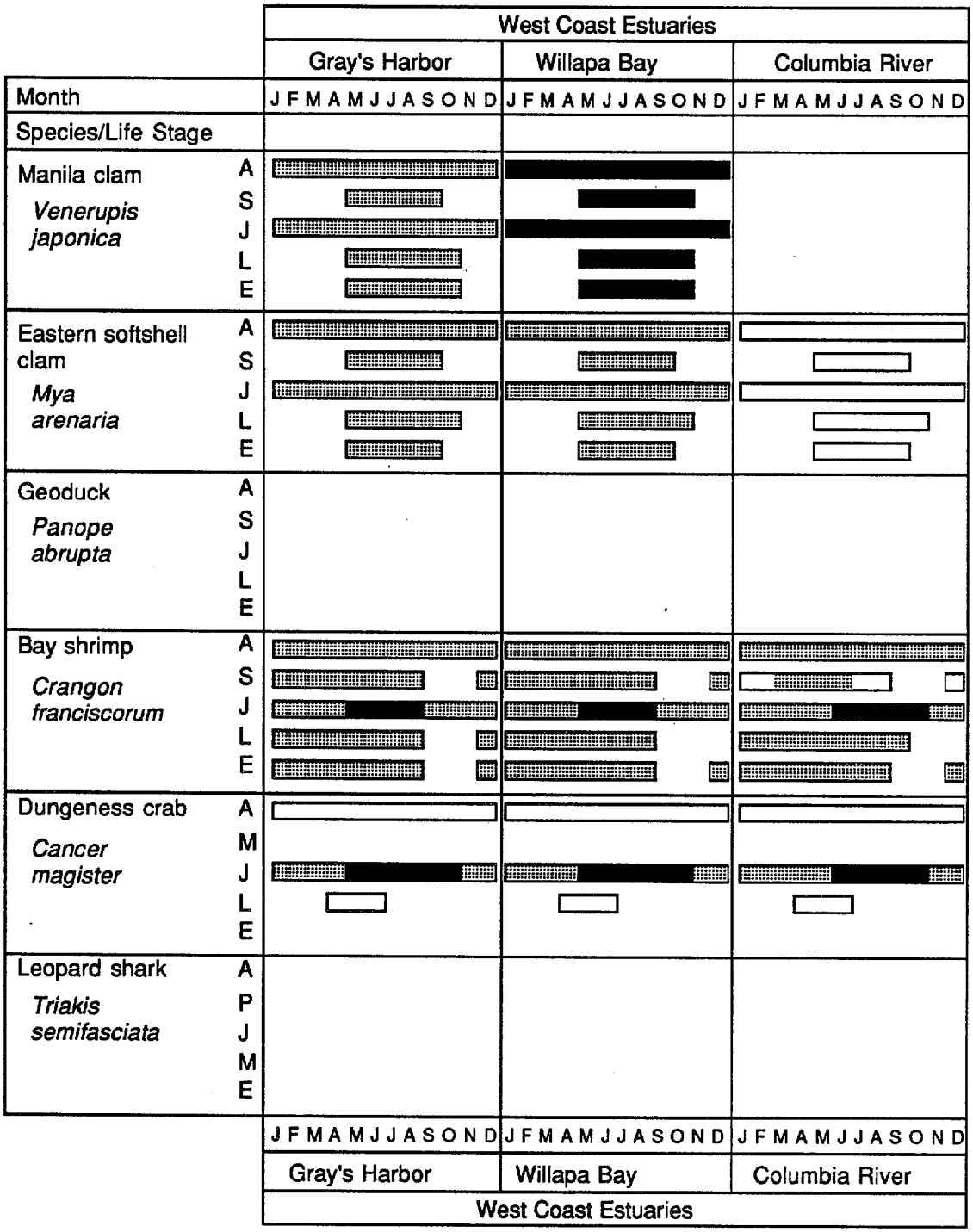
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

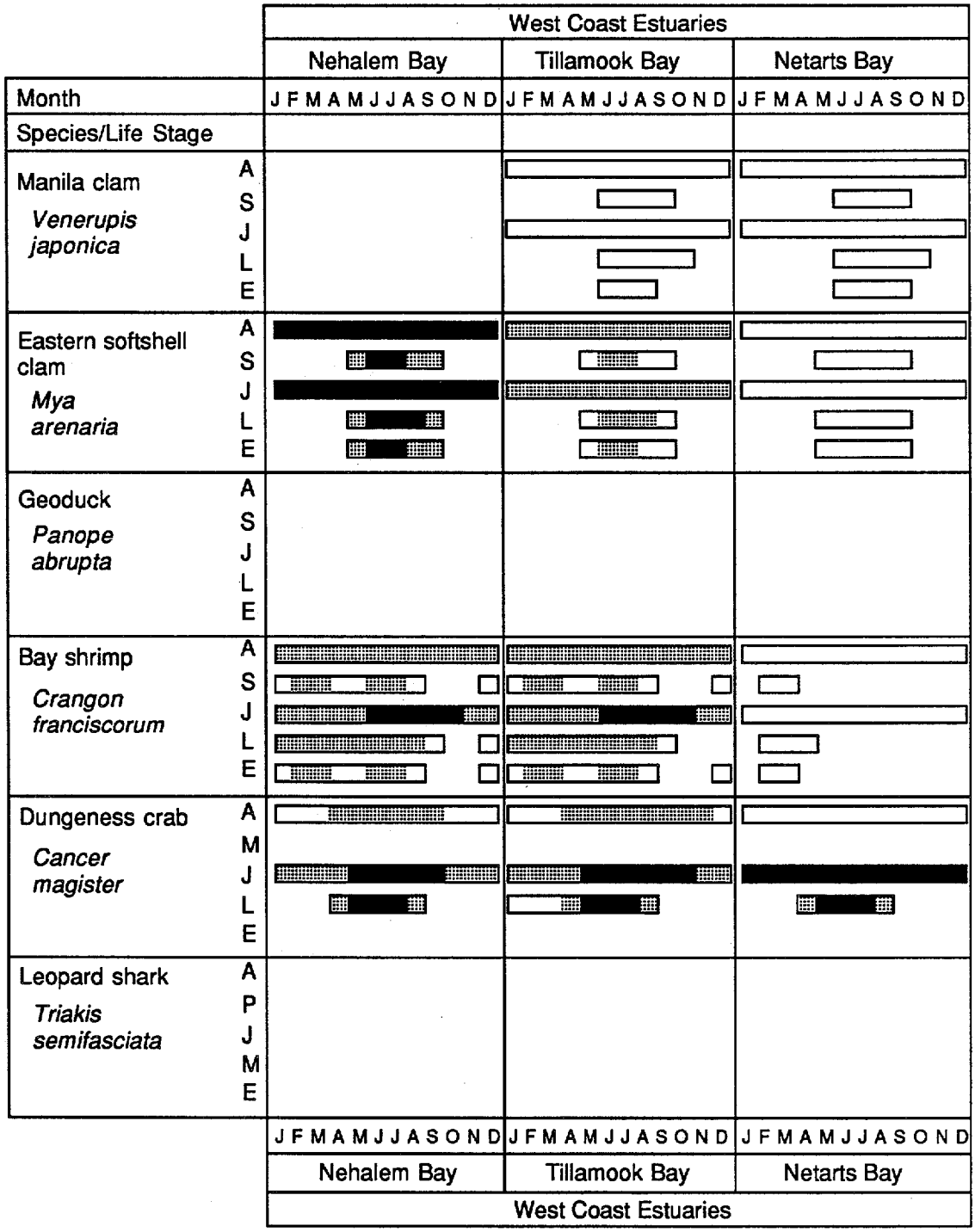
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

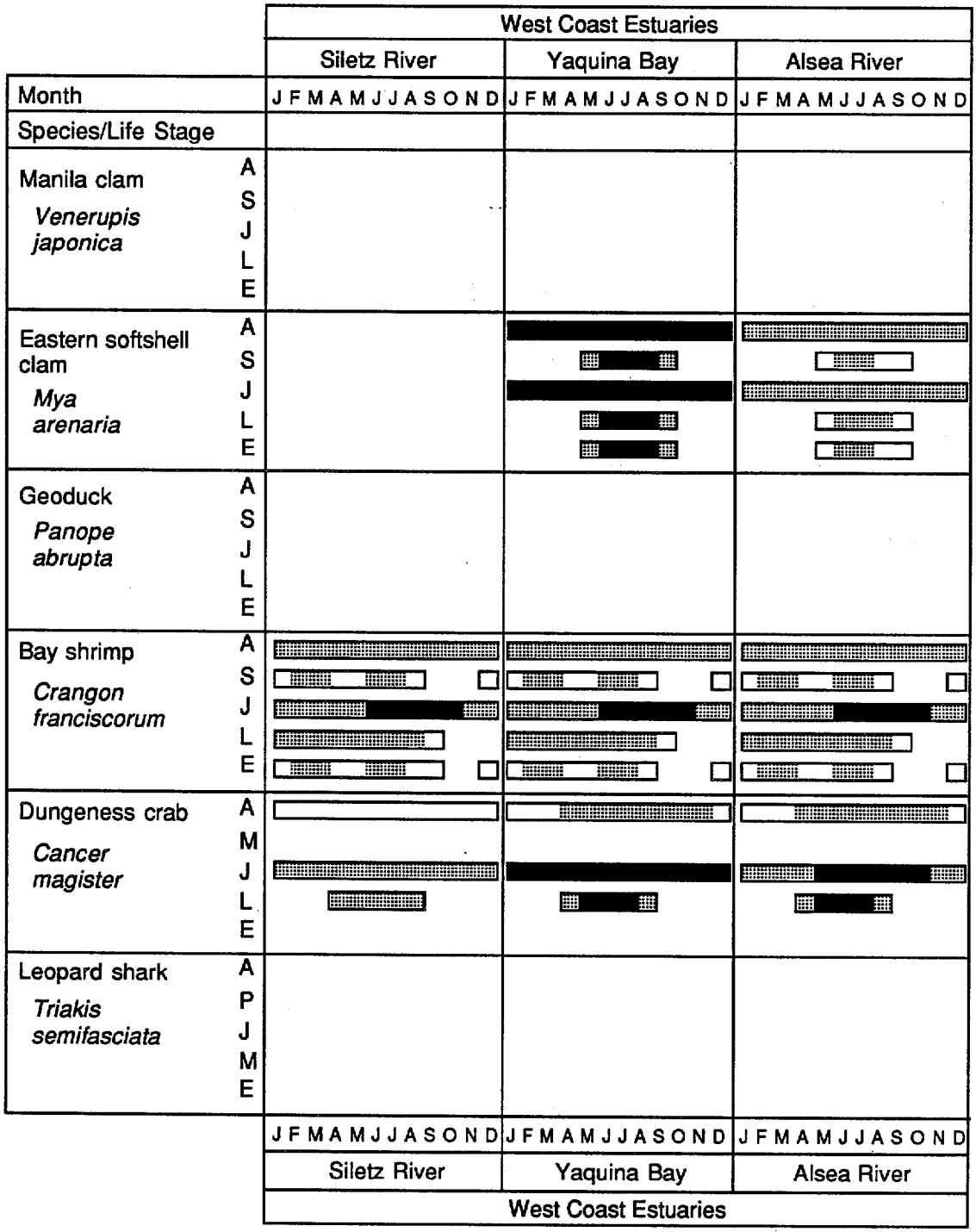
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

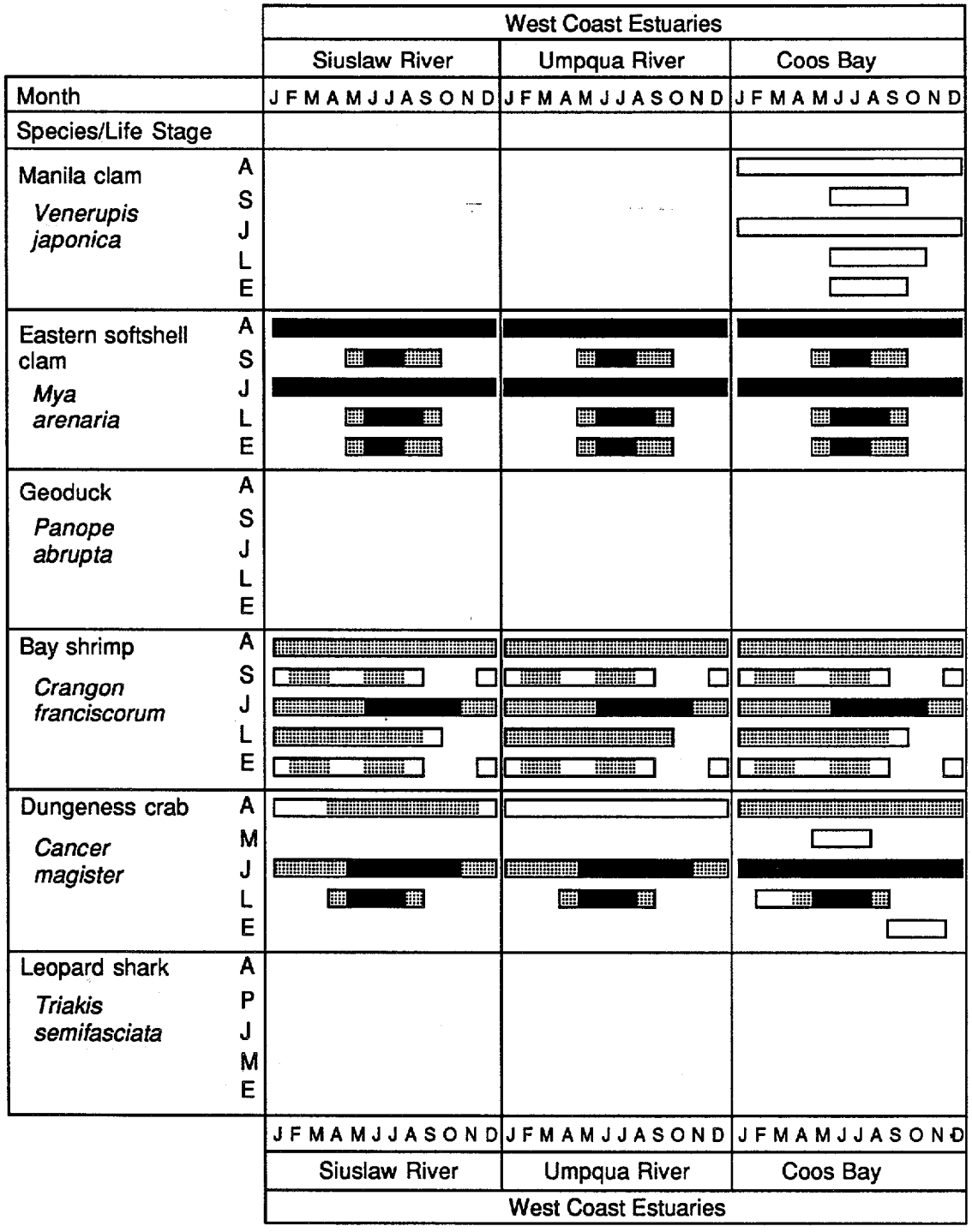
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

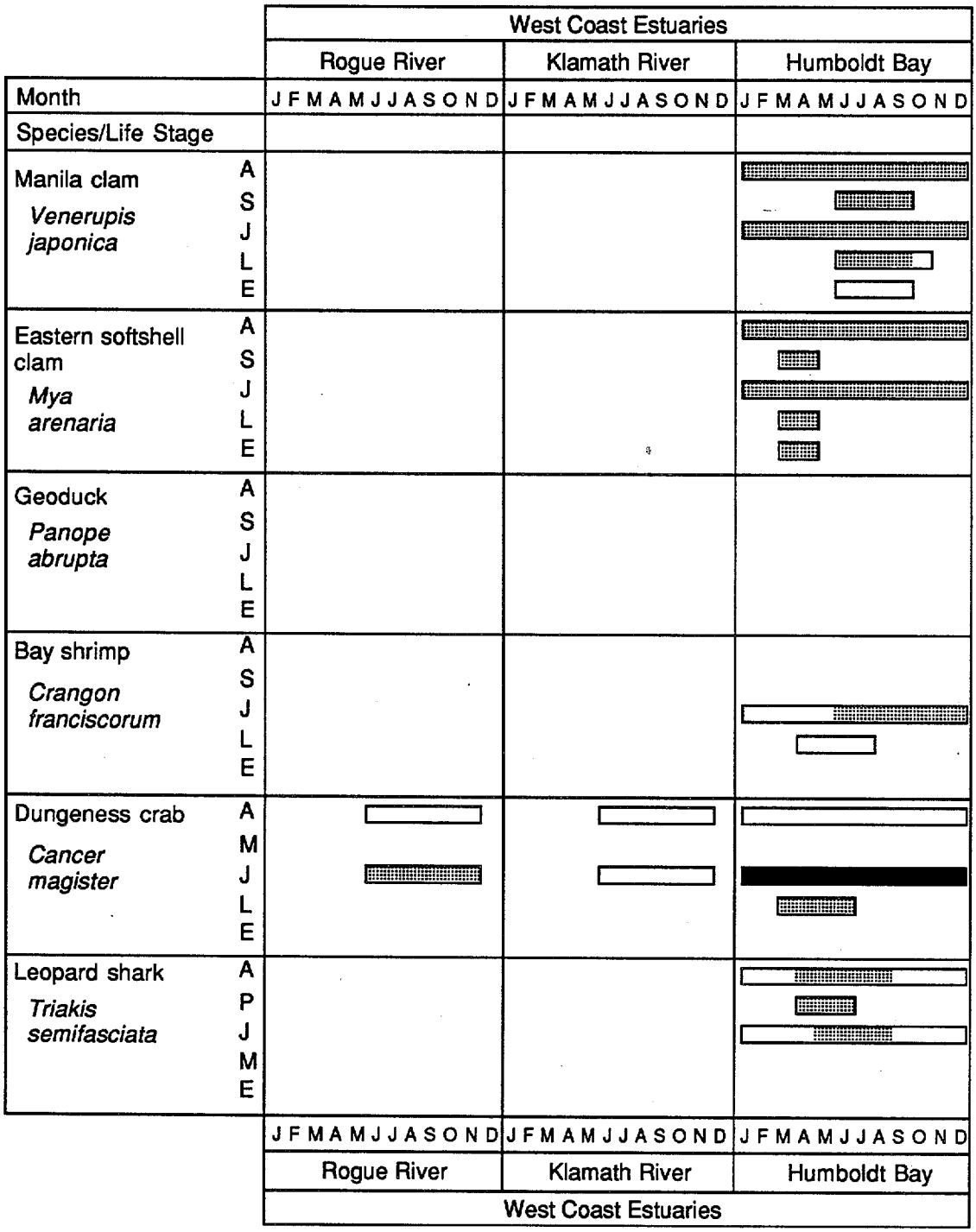
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

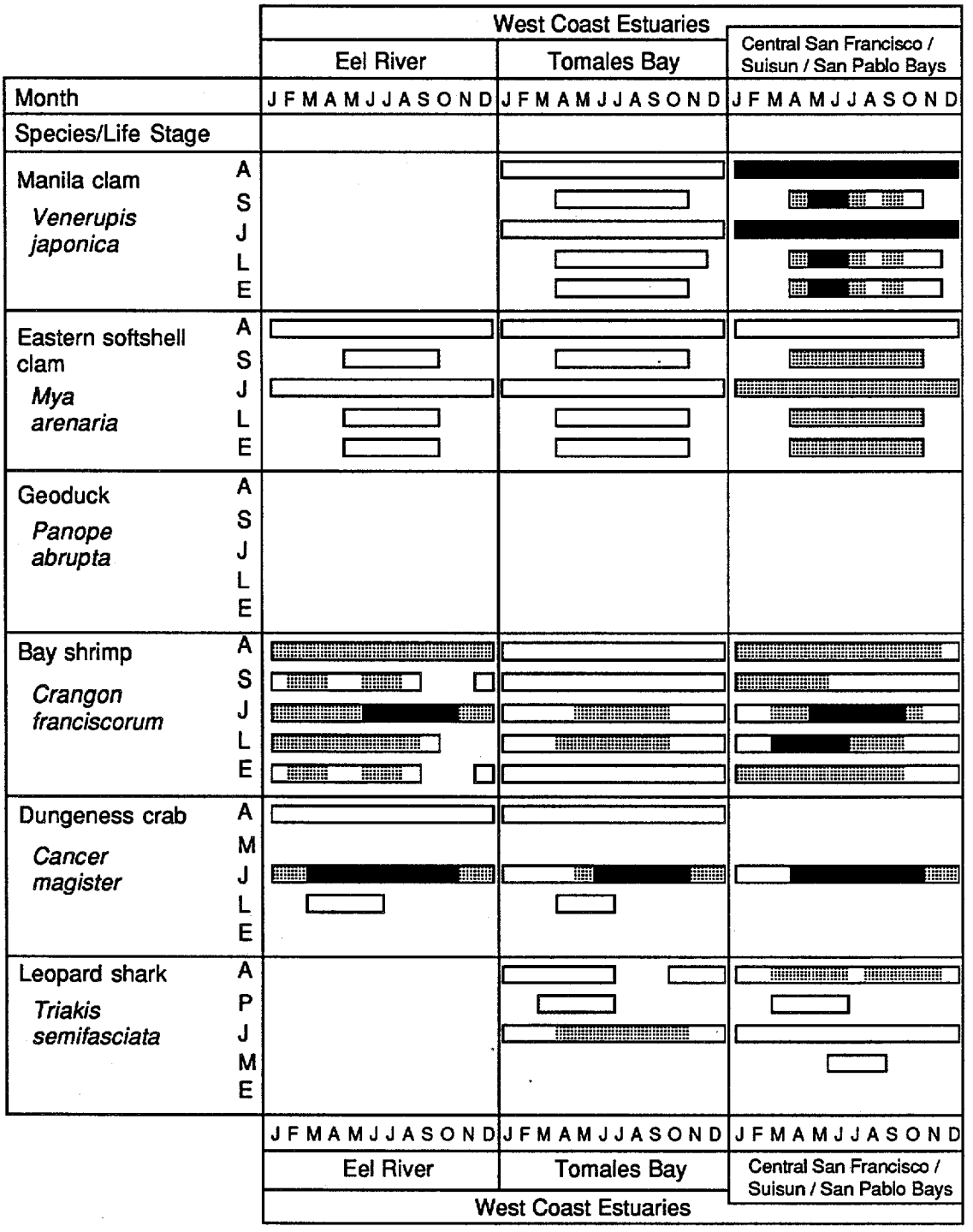
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

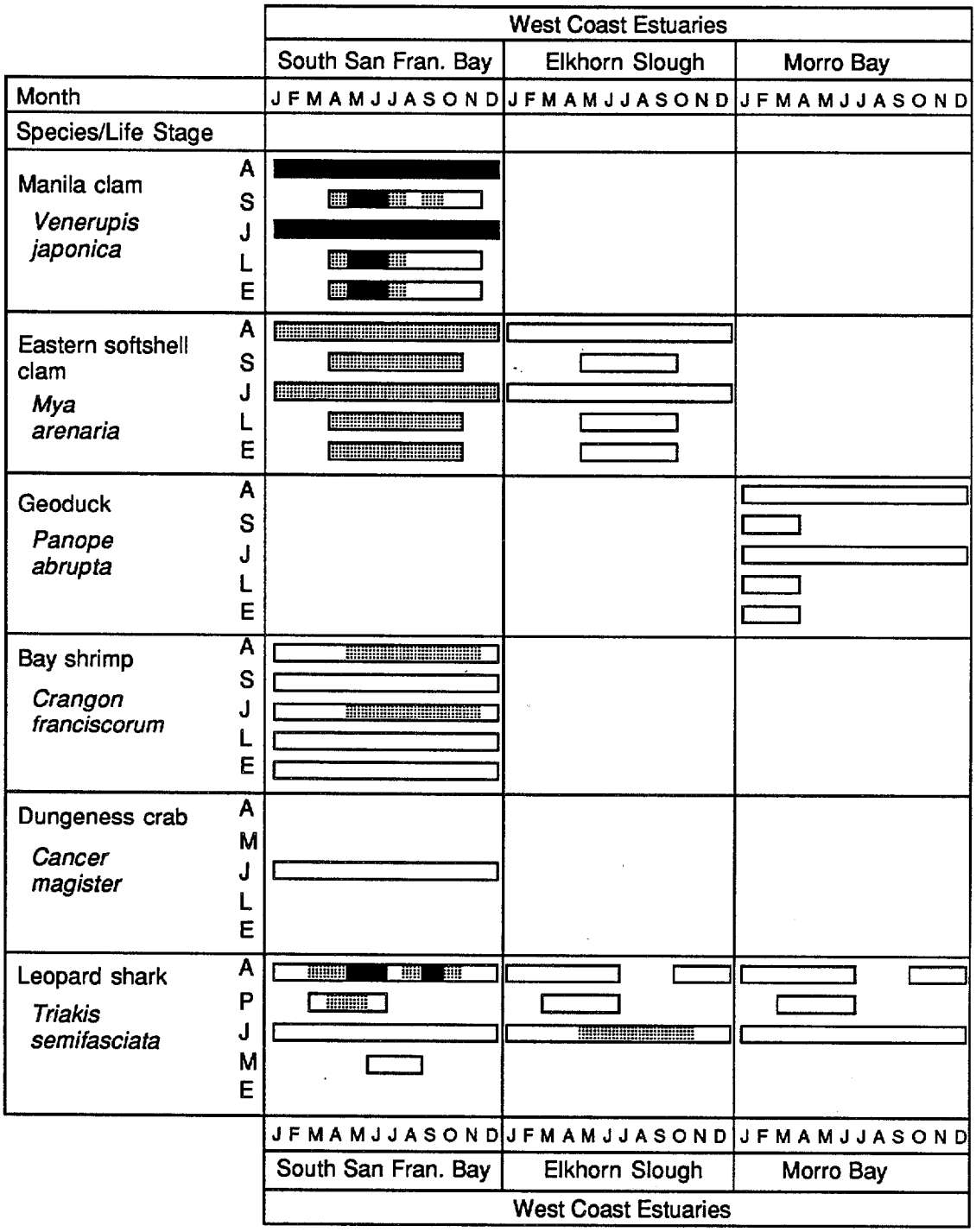
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

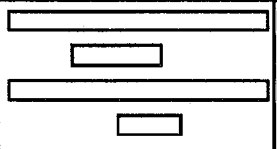
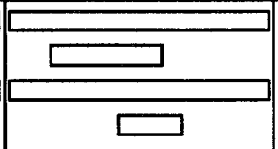
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Manila clam *Venerupis japonica*	A S J L E			
Eastern softshell clam *Mya arenaria*	A S J L E			
Geoduck *Panope abrupta*	A S J L E			
Bay shrimp *Crangon franciscorum*	A S J L E			
Dungeness crab *Cancer magister*	A M J L E			
Leopard shark *Triakis semifasciata*	A P J M E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Anaheim Bay	Newport Bay	Mission Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Manila clam *Venerupis japonica*	A S J L E			
Eastern softshell clam *Mya arenaria*	A S J L E			
Geoduck *Panope abrupta*	A S J L E			
Bay shrimp *Crangon franciscorum*	A S J L E			
Dungeness crab *Cancer magister*	A M J L E			
Leopard shark *Triakis semifasciata*	A P J M E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Anaheim Bay	Newport Bay	Mission Bay
		West Coast Estuaries		

Relative Abundance

- ■ Highly Abundant
- ▦ Abundant
- ▭ Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition
- M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries	
		San Diego Bay	Tijuana Estuary
Month		J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage			
Manila clam *Venerupis japonica*	A S J L E		
Eastern softshell clam *Mya arenaria*	A S J L E		
Geoduck *Panope abrupta*	A S J L E		
Bay shrimp *Crangon franciscorum*	A S J L E		
Dungeness crab *Cancer magister*	A M J L E		
Leopard shark *Triakis semifasciata*	A P J M E		
		J F M A M J J A S O N D	J F M A M J J A S O N D
		San Diego Bay	Tijuana Estuary
		West Coast Estuaries	

Relative Abundance

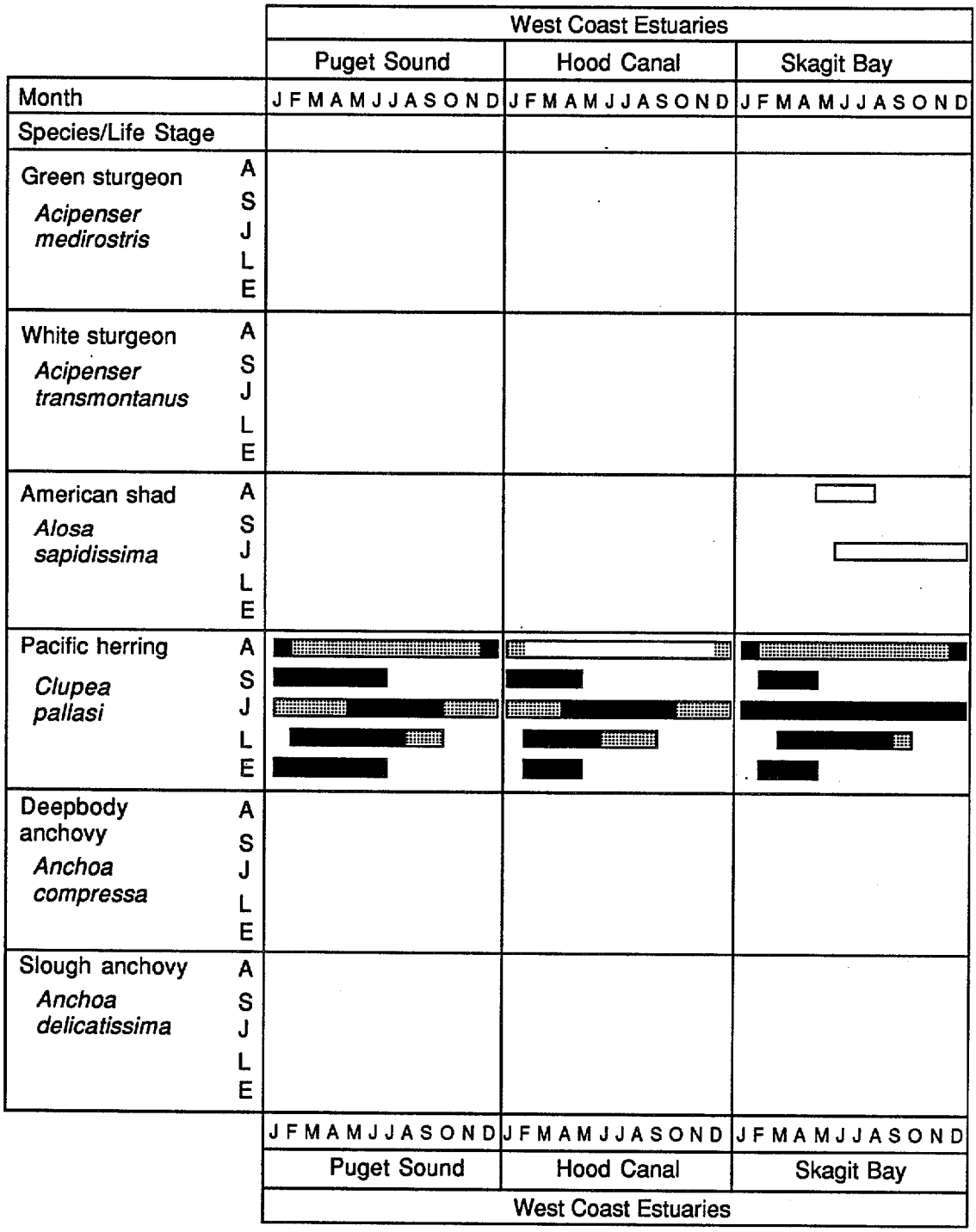
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

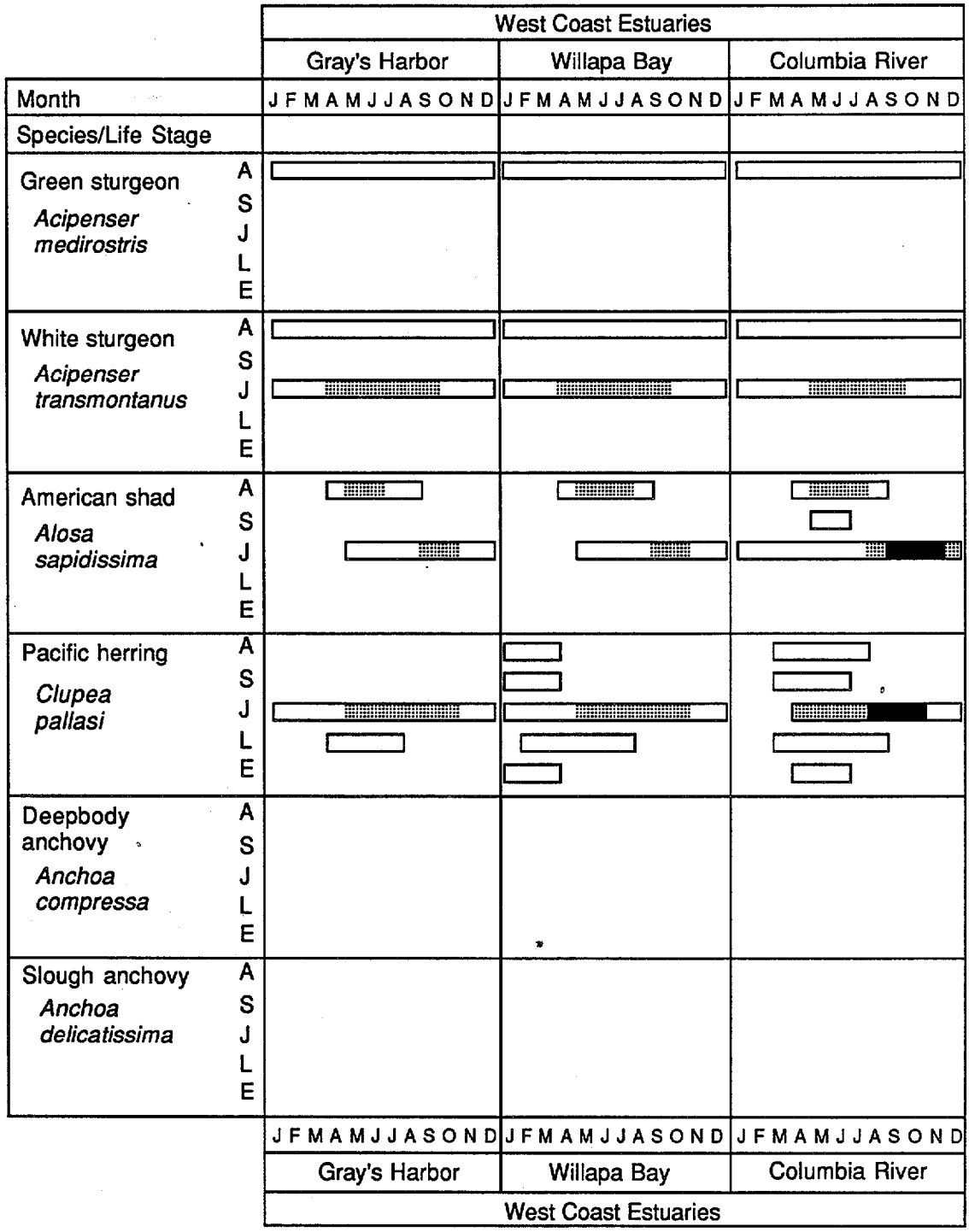
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3, continued. Temporal distribution (revised 1/91).

		West Coast Estuaries		
		Nehalem Bay	Tillamook Bay	Netarts Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Green sturgeon *Acipenser medirostris*	A S J L E			
White sturgeon *Acipenser transmontanus*	A S J L E			
American shad *Alosa sapidissima*	A S J L E			
Pacific herring *Clupea pallasi*	A S J L E			
Deepbody anchovy *Anchoa compressa*	A S J L E			
Slough anchovy *Anchoa delicatissima*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Nehalem Bay	Tillamook Bay	Netarts Bay
		West Coast Estuaries		

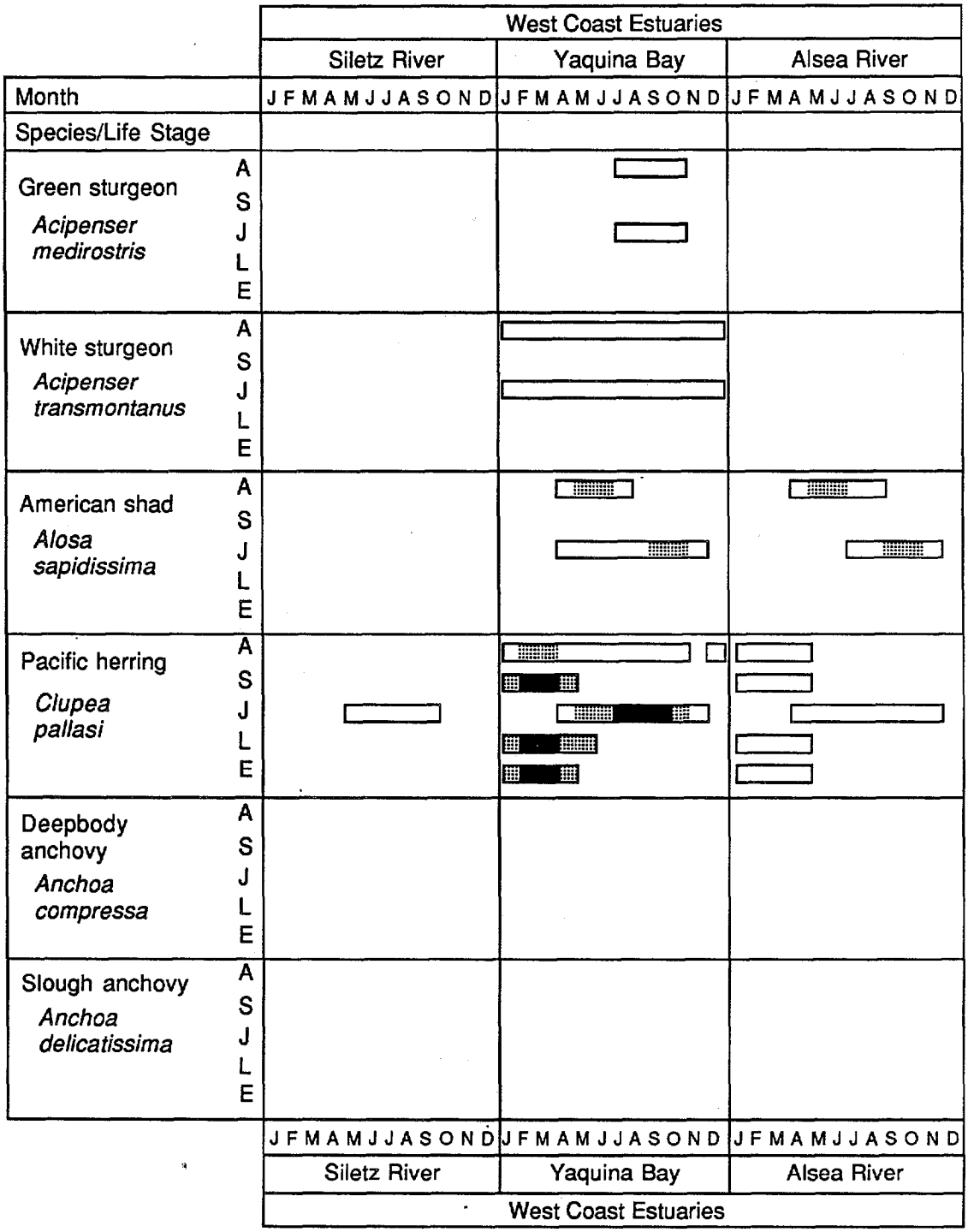
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

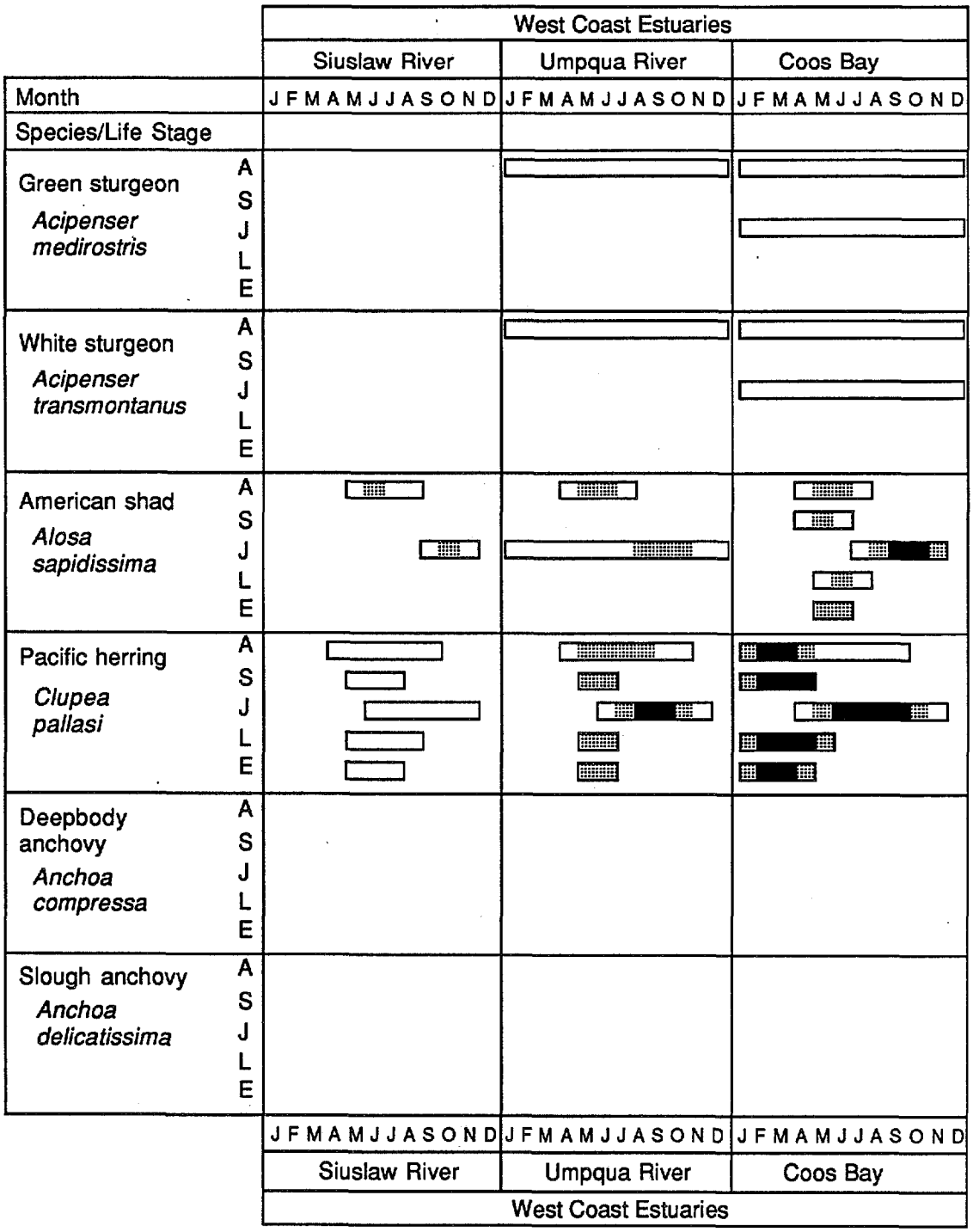
A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution (revised 1/91).



Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

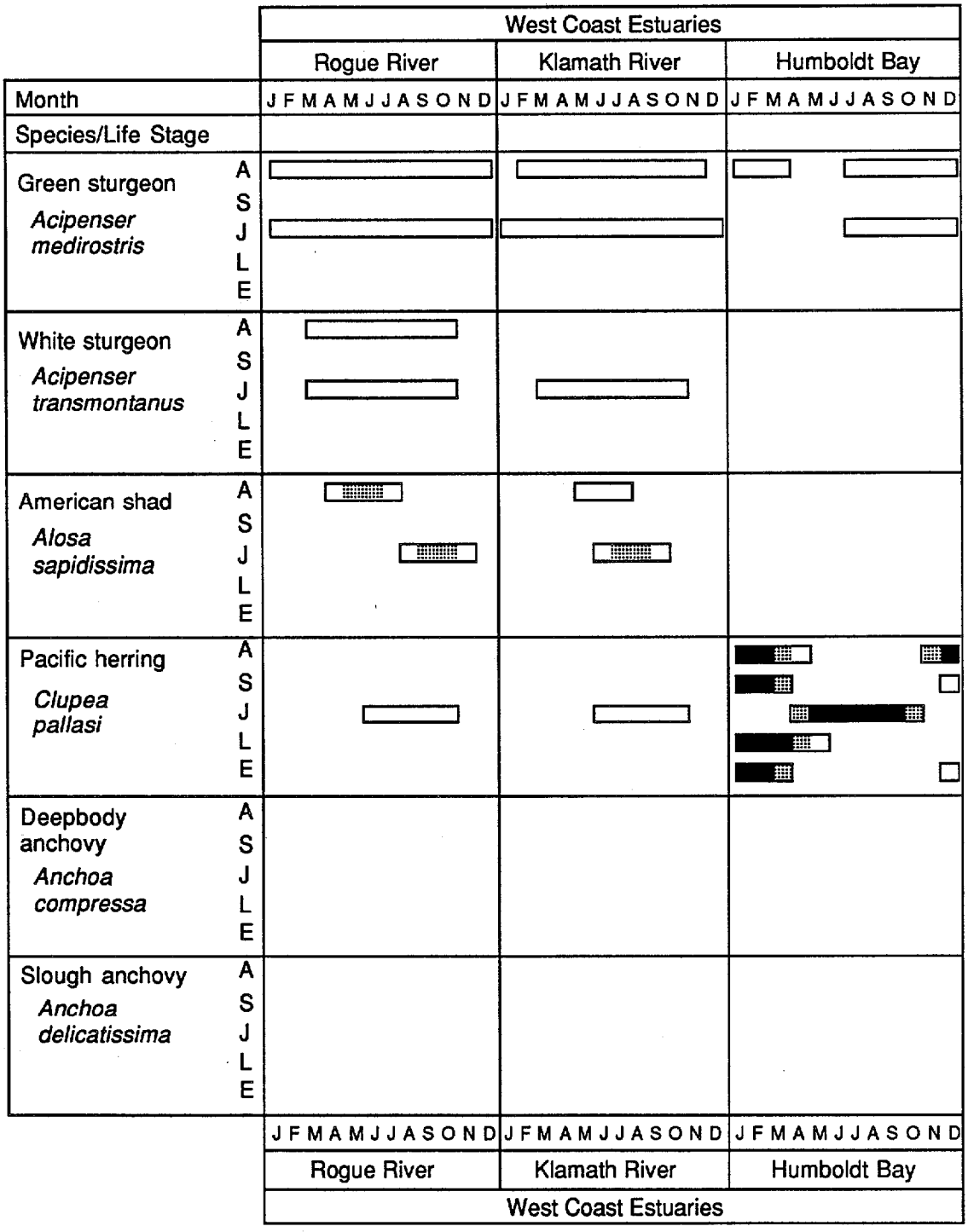
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

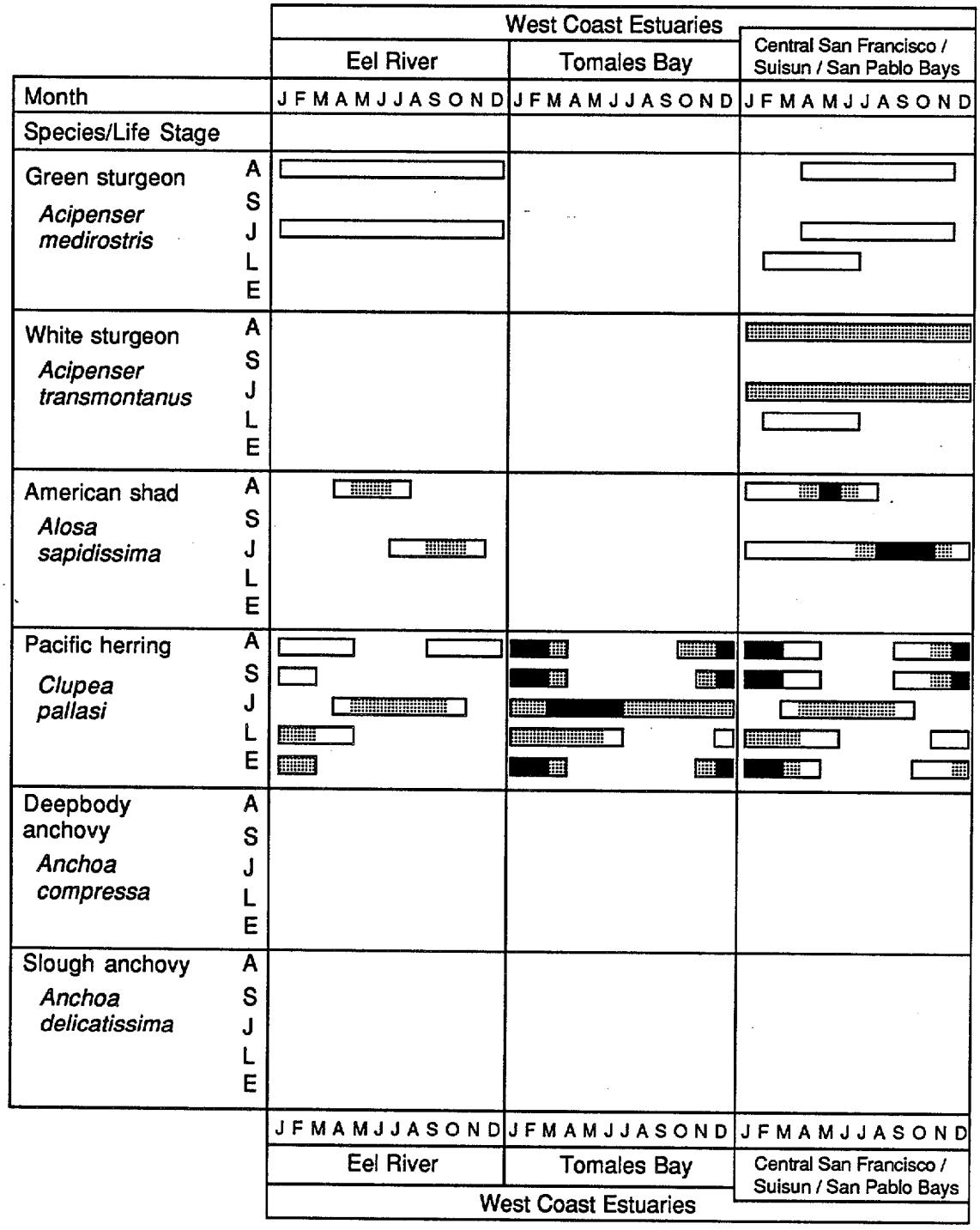
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

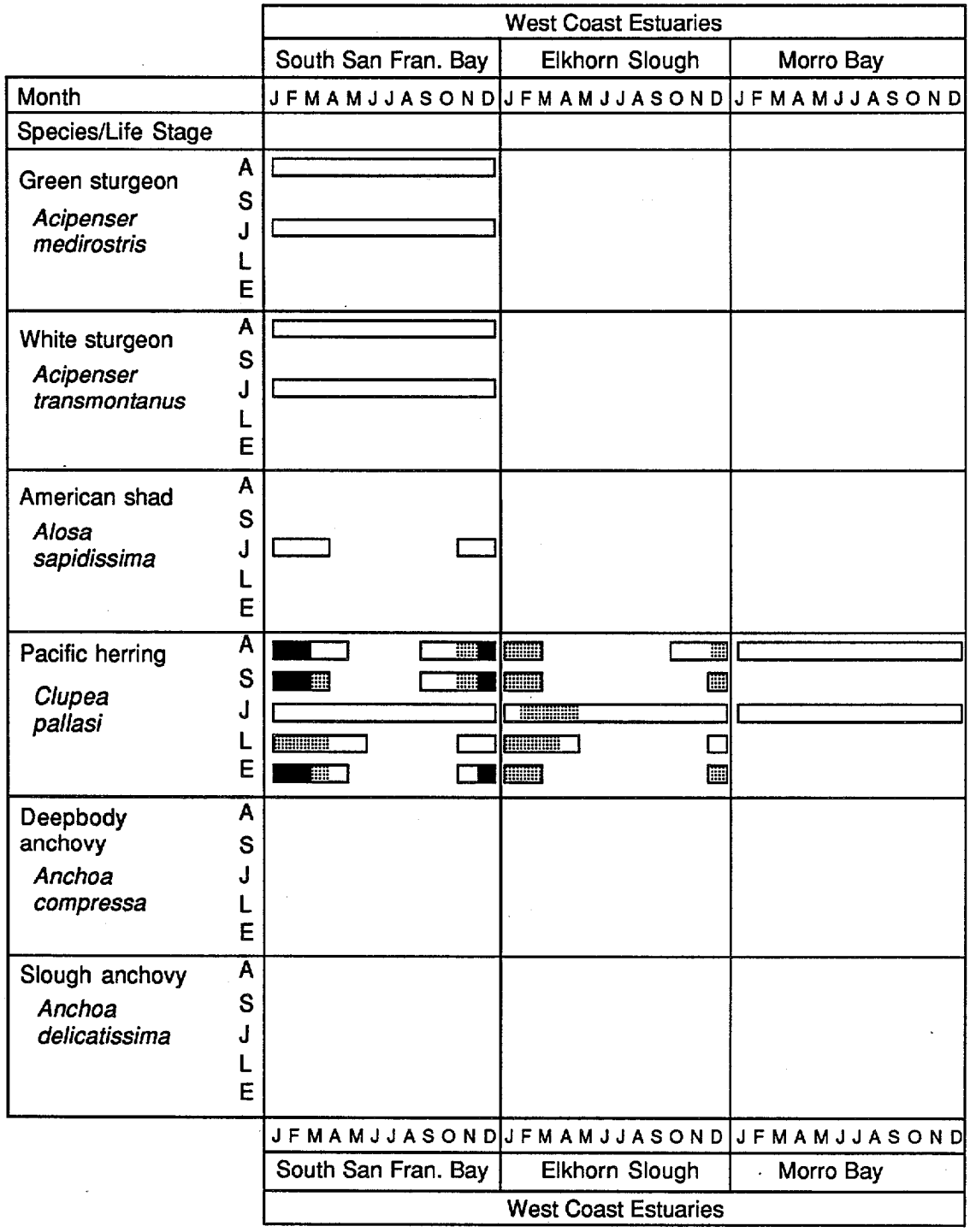
Data Summary Table: Temporal Distribution

Table 3 (continued).



Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

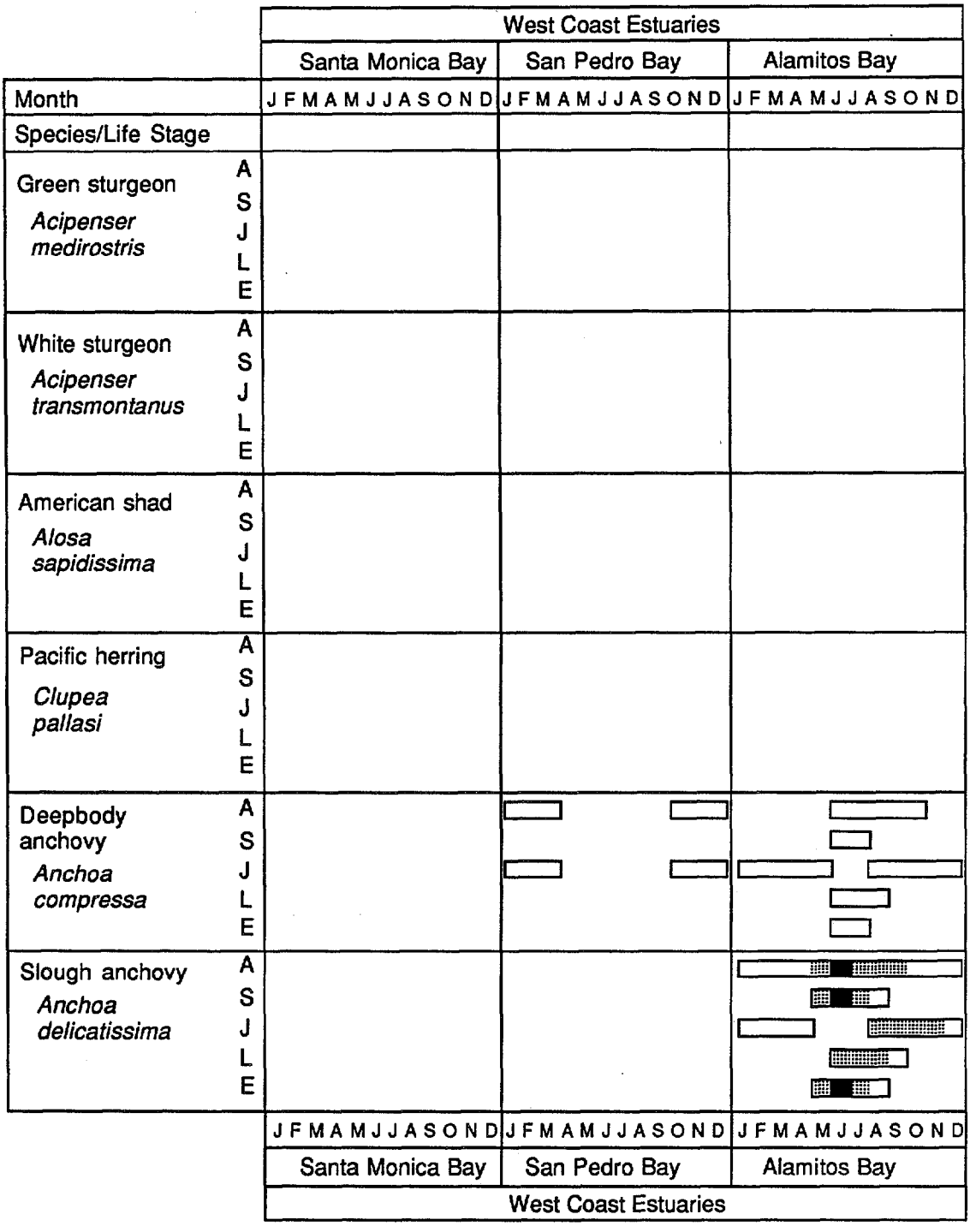
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

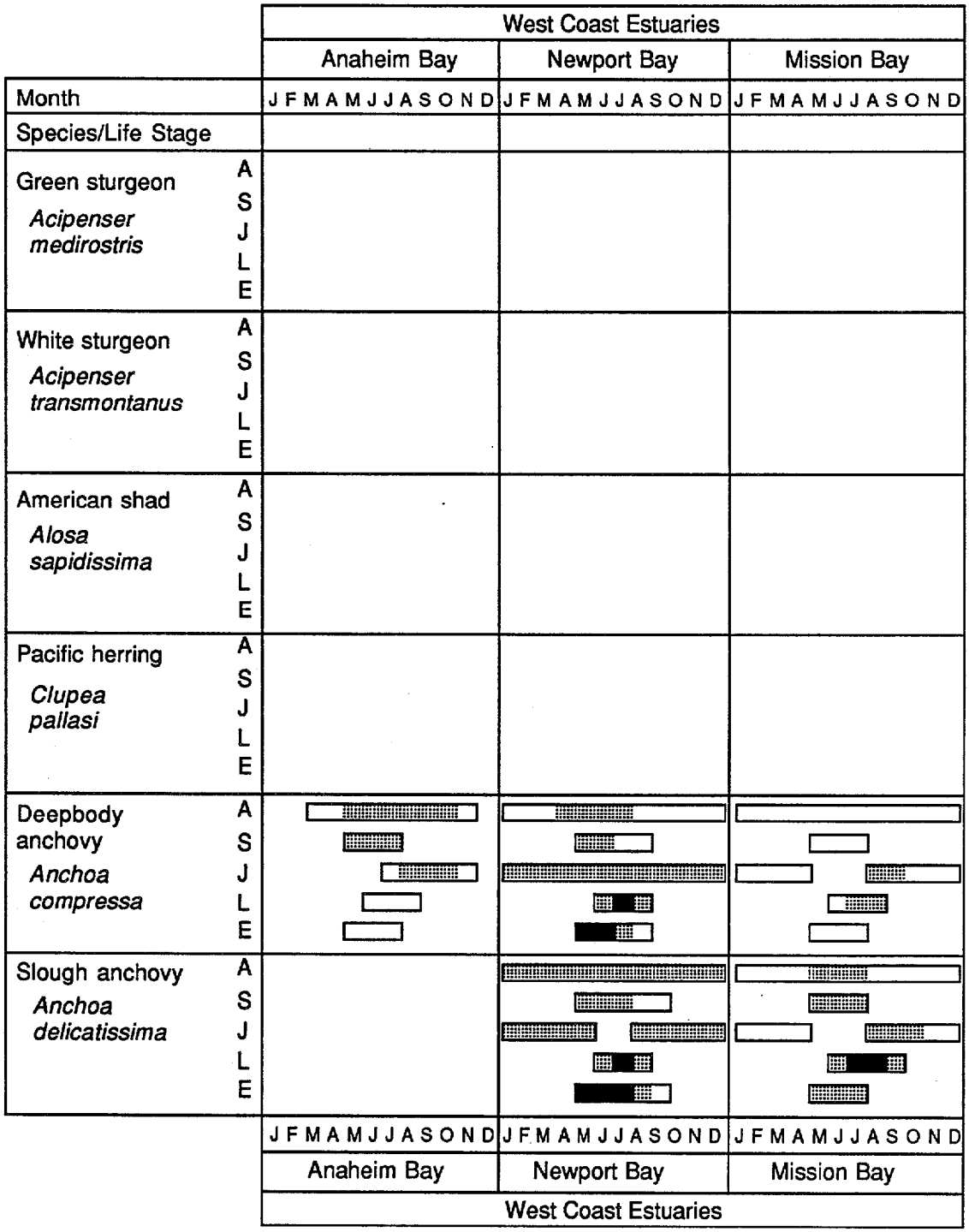
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

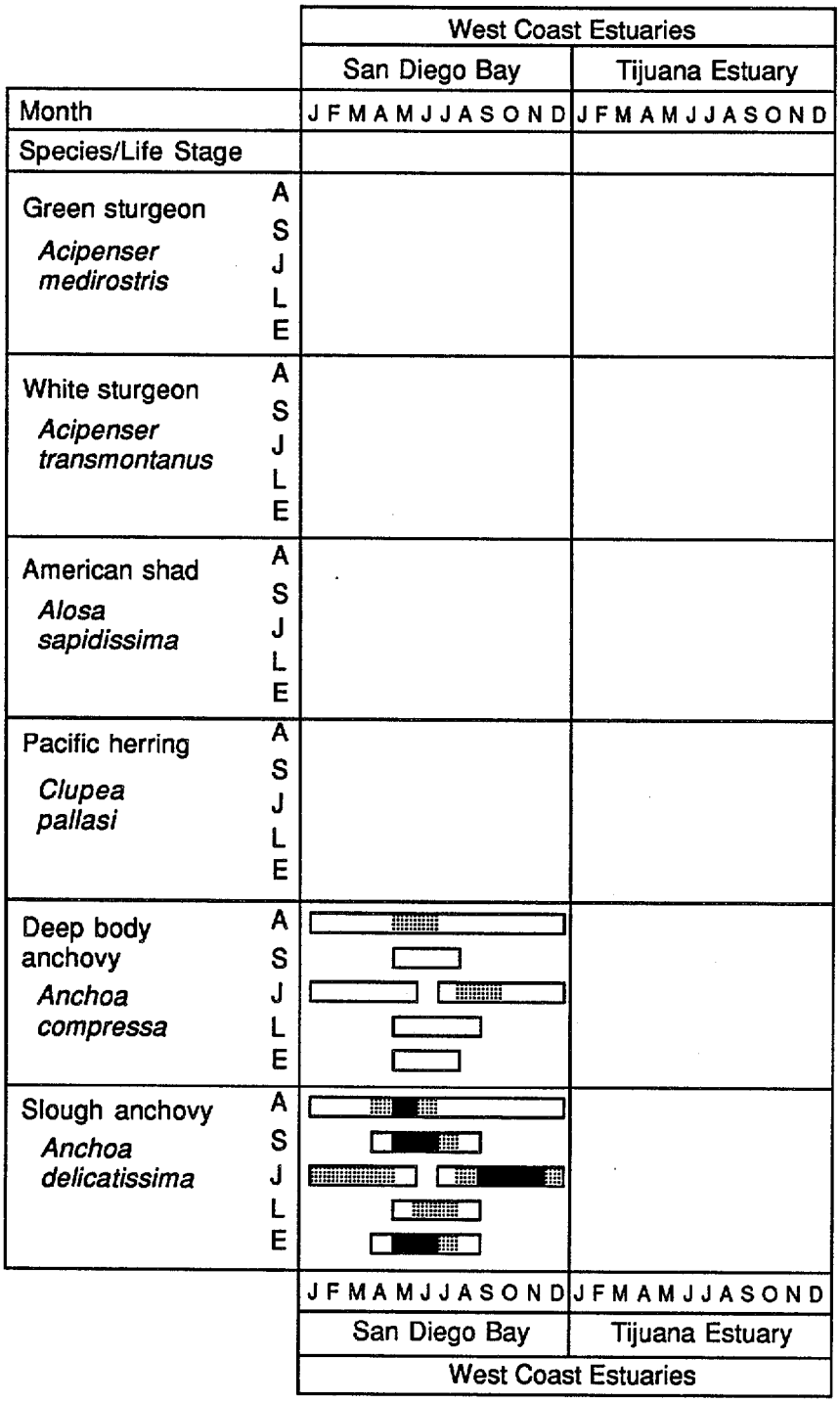
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

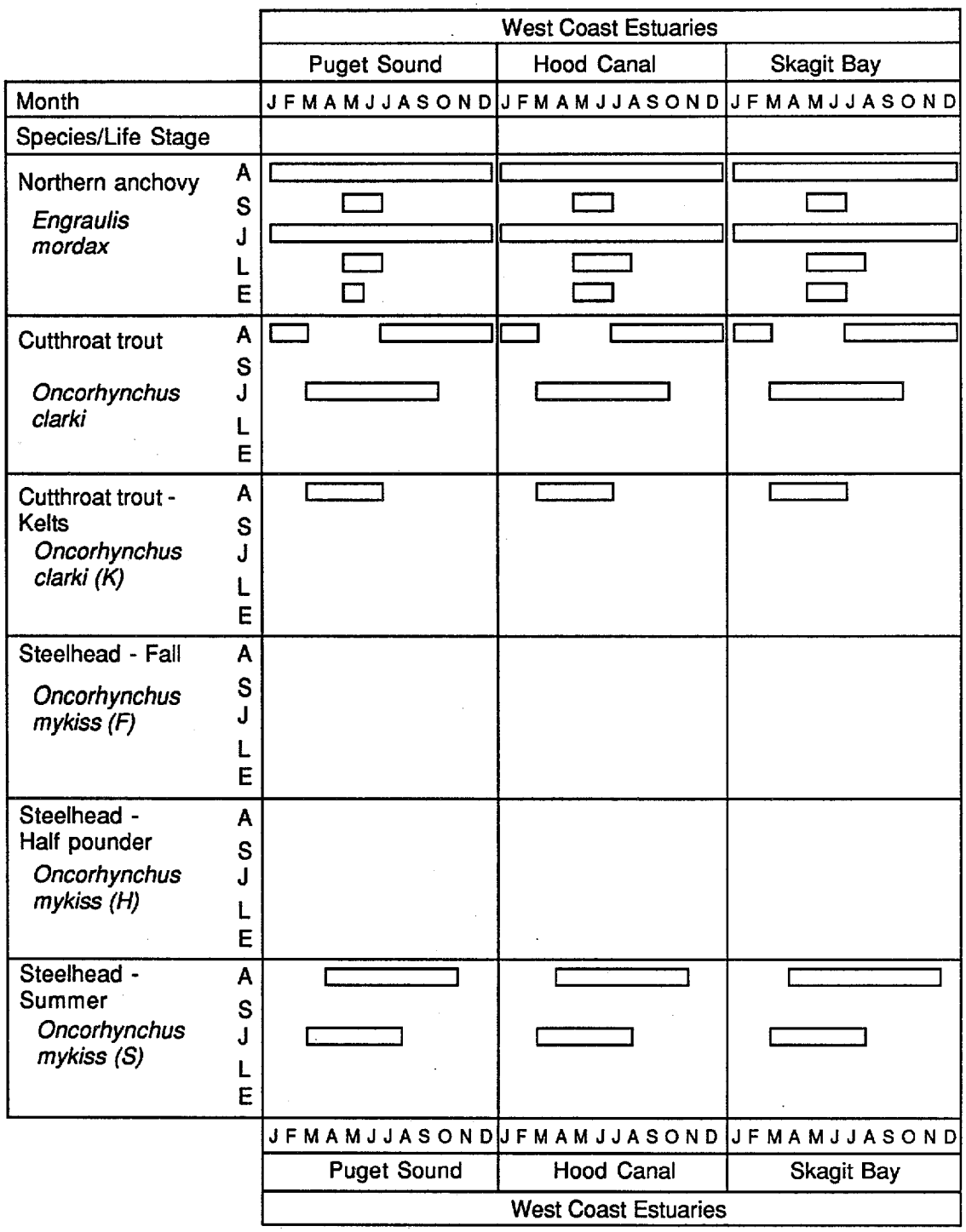
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

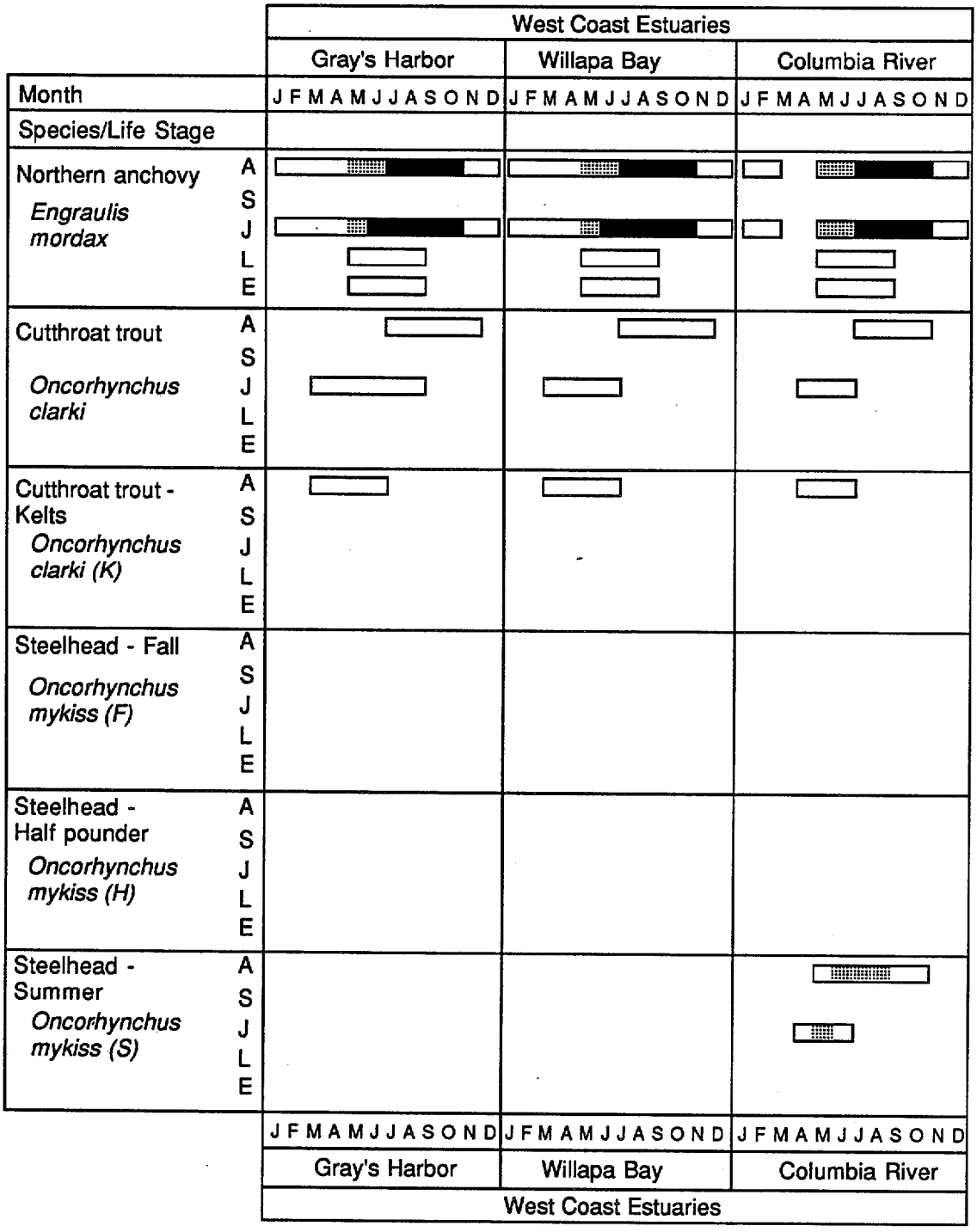
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

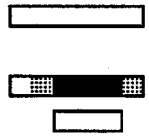
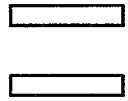
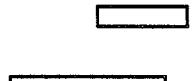
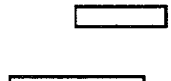
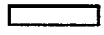
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Nehalem Bay	Tillamook Bay	Netarts Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Northern anchovy *Engraulis mordax*	A S J L E			
Cutthroat trout *Oncorhynchus clarki*	A S J L E			
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A S J L E			
Steelhead - Fall *Oncorhynchus mykiss (F)*	A S J L E			
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A S J L E			
Steelhead - Summer *Oncorhynchus mykiss (S)*	A S J L E		 	
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Nehalem Bay	Tillamook Bay	Netarts Bay
		West Coast Estuaries		

Relative Abundance

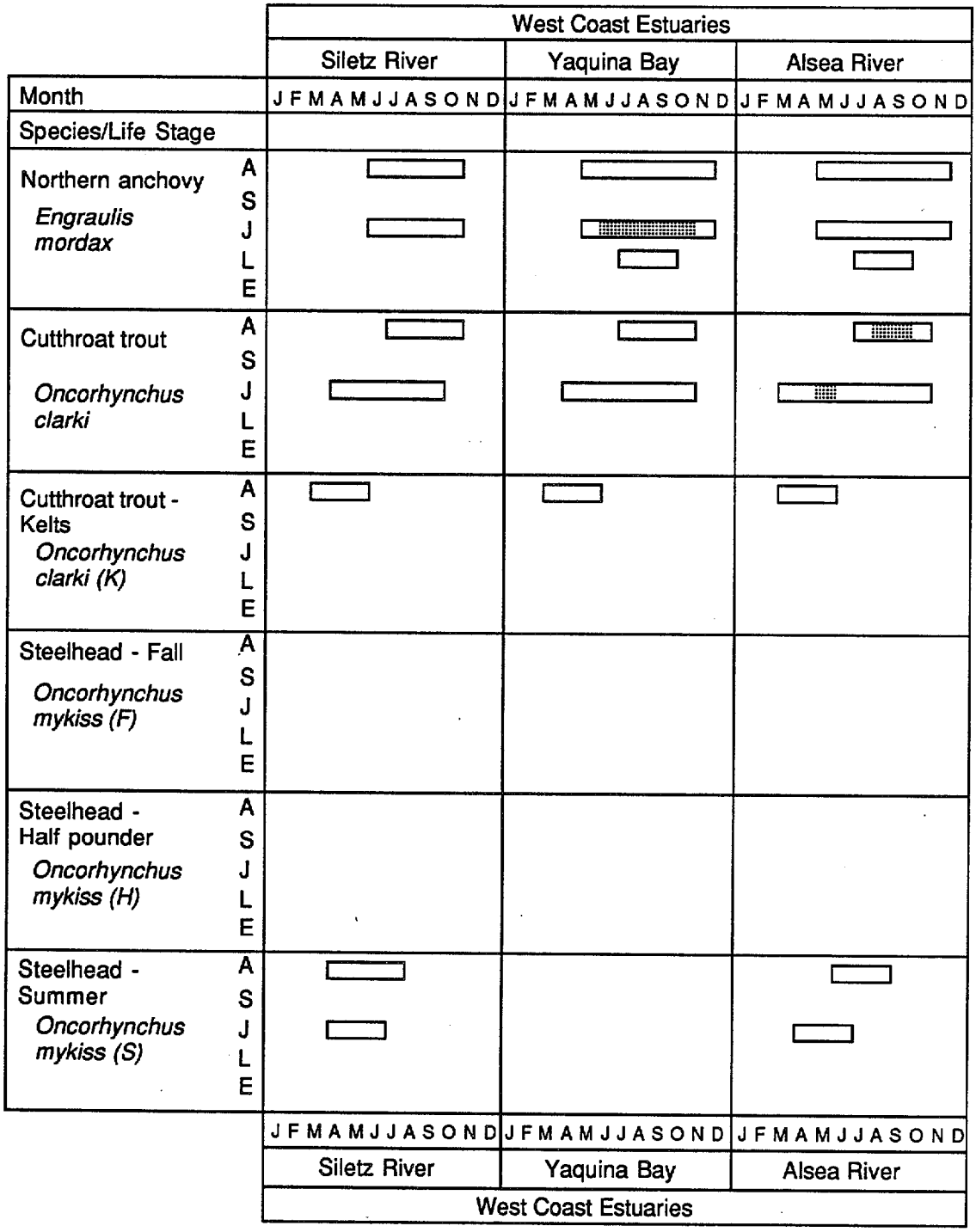
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

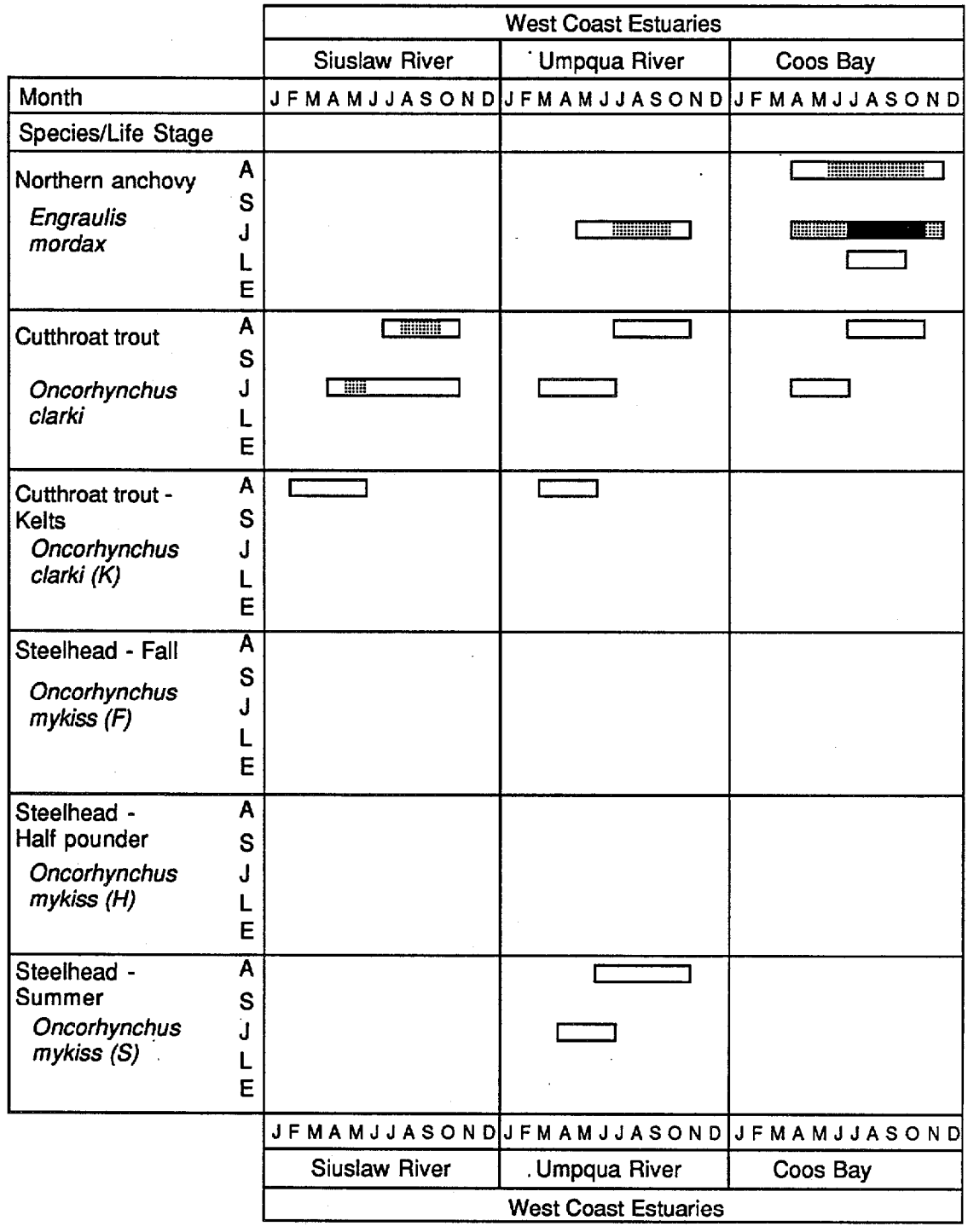
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

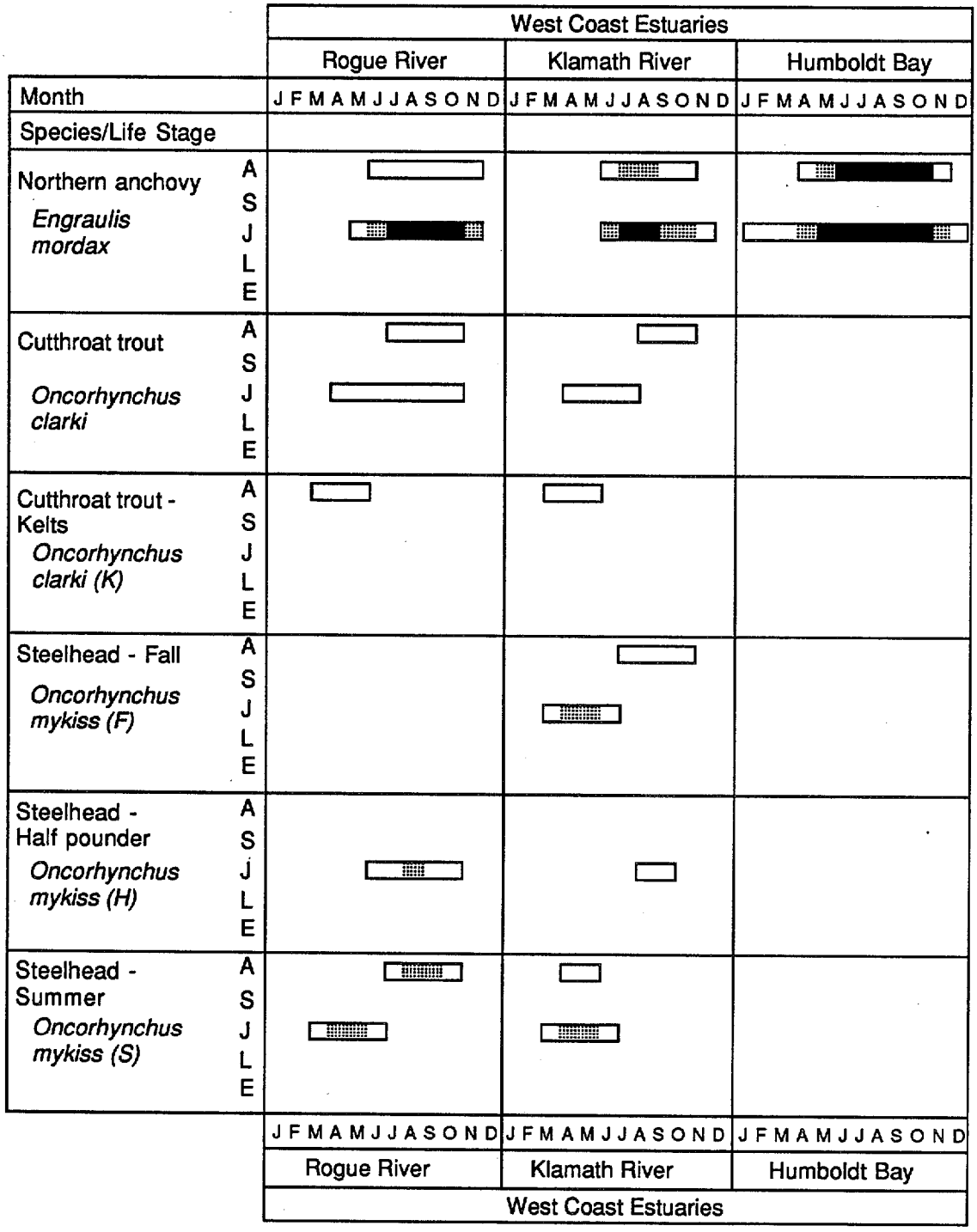
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



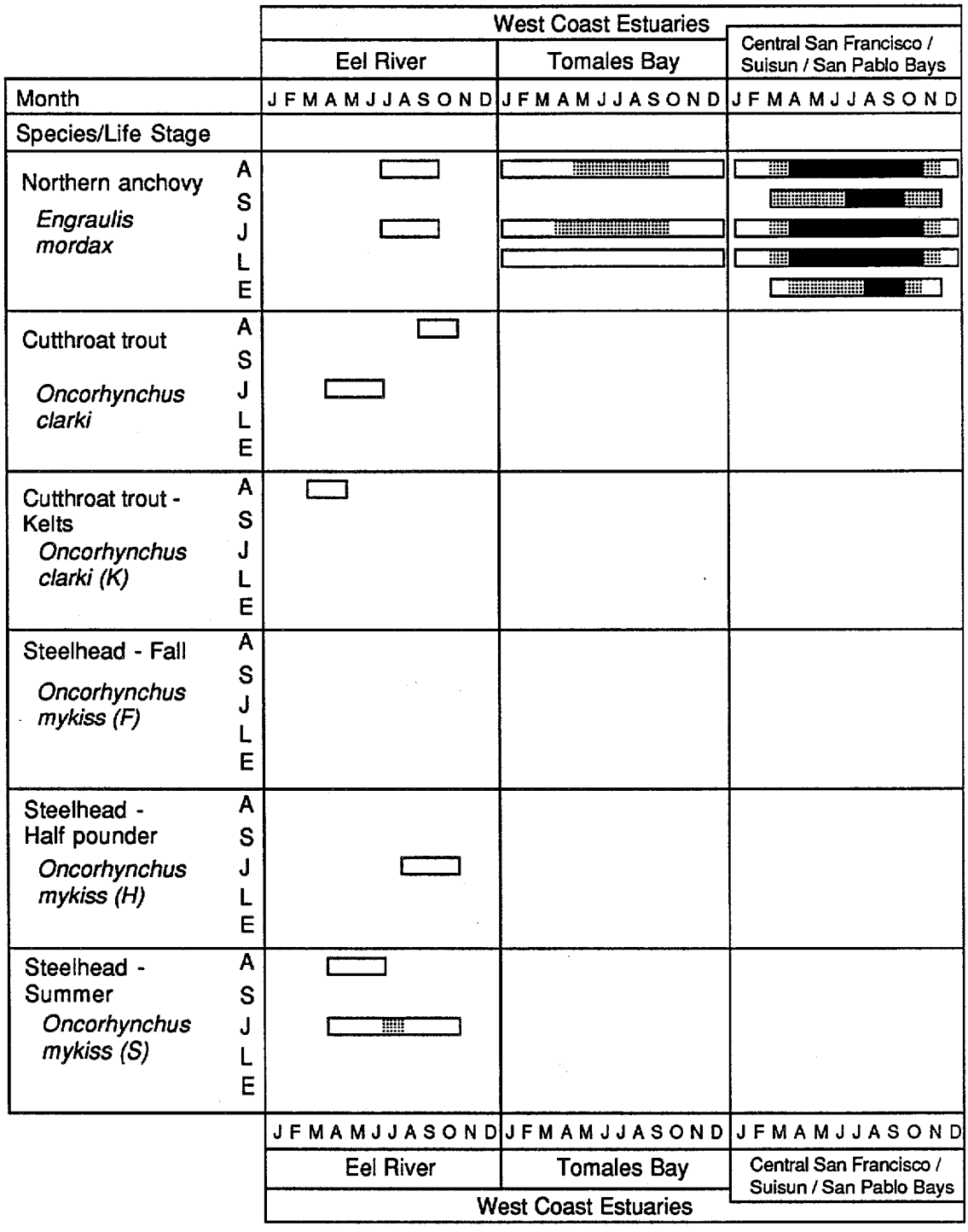
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution and relative abundance



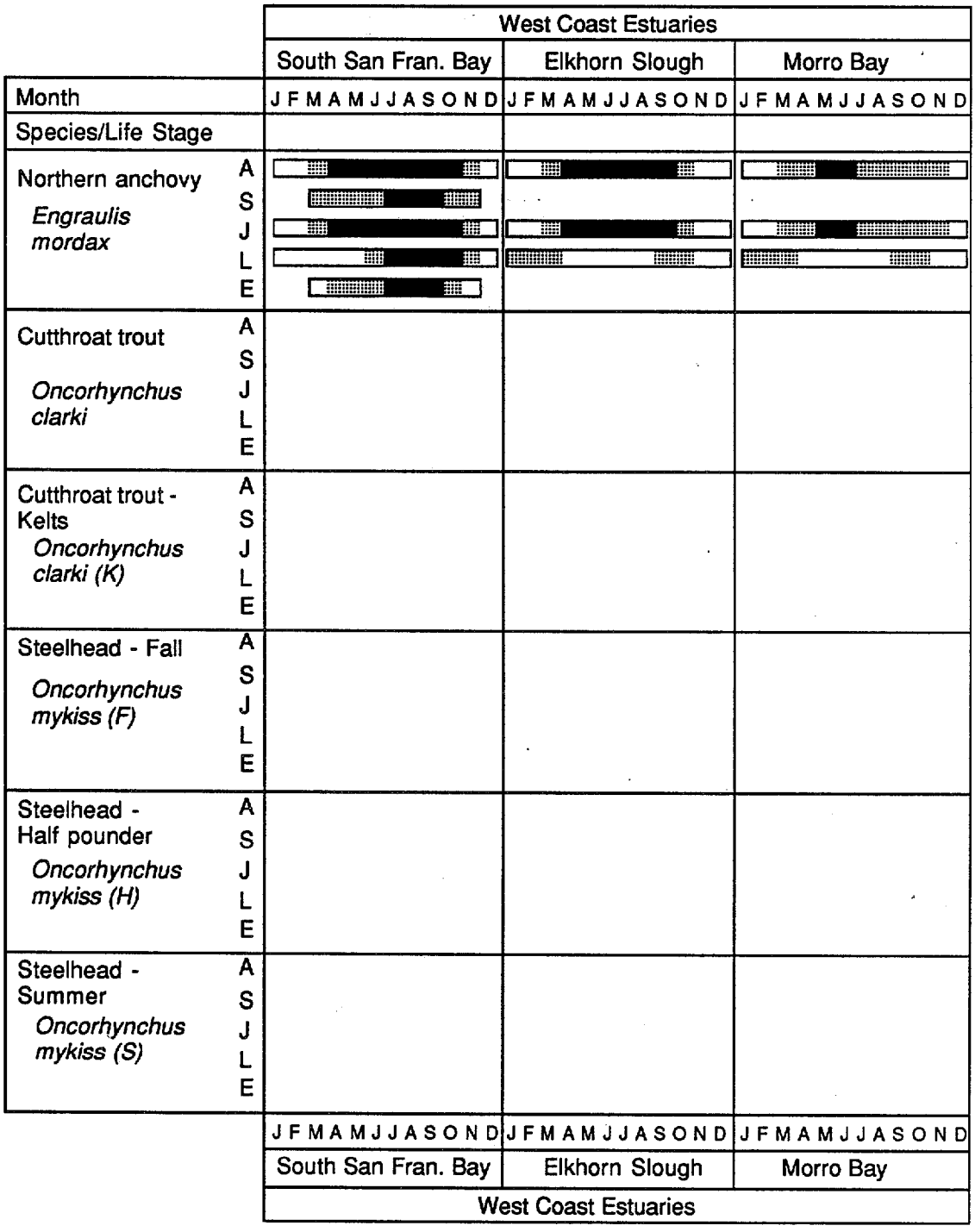
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution and relative abundance



Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Northern anchovy *Engraulis mordax*	A	■	■	▩
	S	▩	▩	
	J	■	■	▩
	L	▩	▩	□
	E	▩	▩	□
Cutthroat trout *Oncorhynchus clarki*	A			
	S			
	J			
	L			
	E			
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A			
	S			
	J			
	L			
	E			
Steelhead - Fall *Oncorhynchus mykiss (F)*	A			
	S			
	J			
	L			
	E			
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A			
	S			
	J			
	L			
	E			
Steelhead - Summer *Oncorhynchus mykiss (S)*	A			
	S			
	J			
	L			
	E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
		West Coast Estuaries		

Relative Abundance

■ Highly Abundant

▩ Abundant

□ Common

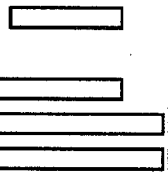
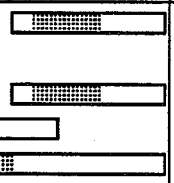
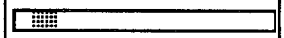
Blank Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Anaheim Bay	Newport Bay	Mission Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Northern anchovy *Engraulis mordax*	A S J L E			
Cutthroat trout *Oncorhynchus clarki*	A S J L E			
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A S J L E			
Steelhead - Fall *Oncorhynchus mykiss (F)*	A S J L E			
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A S J L E			
Steelhead - Summer *Oncorhynchus mykiss (S)*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Anaheim Bay	Newport Bay	Mission Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries	
		San Diego Bay	Tijuana Estuary
Month		J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage			
Northern anchovy *Engraulis mordax*	A	▭	
	S		
	J	▭	
	L	▭	▩
	E	▭	▩
Cutthroat trout *Oncorhynchus clarki*	A		
	S		
	J		
	L		
	E		
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A		
	S		
	J		
	L		
	E		
Steelhead - Fall *Oncorhynchus mykiss (F)*	A		
	S		
	J		
	L		
	E		
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A		
	S		
	J		
	L		
	E		
Steelhead - Summer *Oncorhynchus mykiss (S)*	A		
	S		
	J		
	L		
	E		
		J F M A M J J A S O N D	J F M A M J J A S O N D
		San Diego Bay	Tijuana Estuary
		West Coast Estuaries	

Relative Abundance

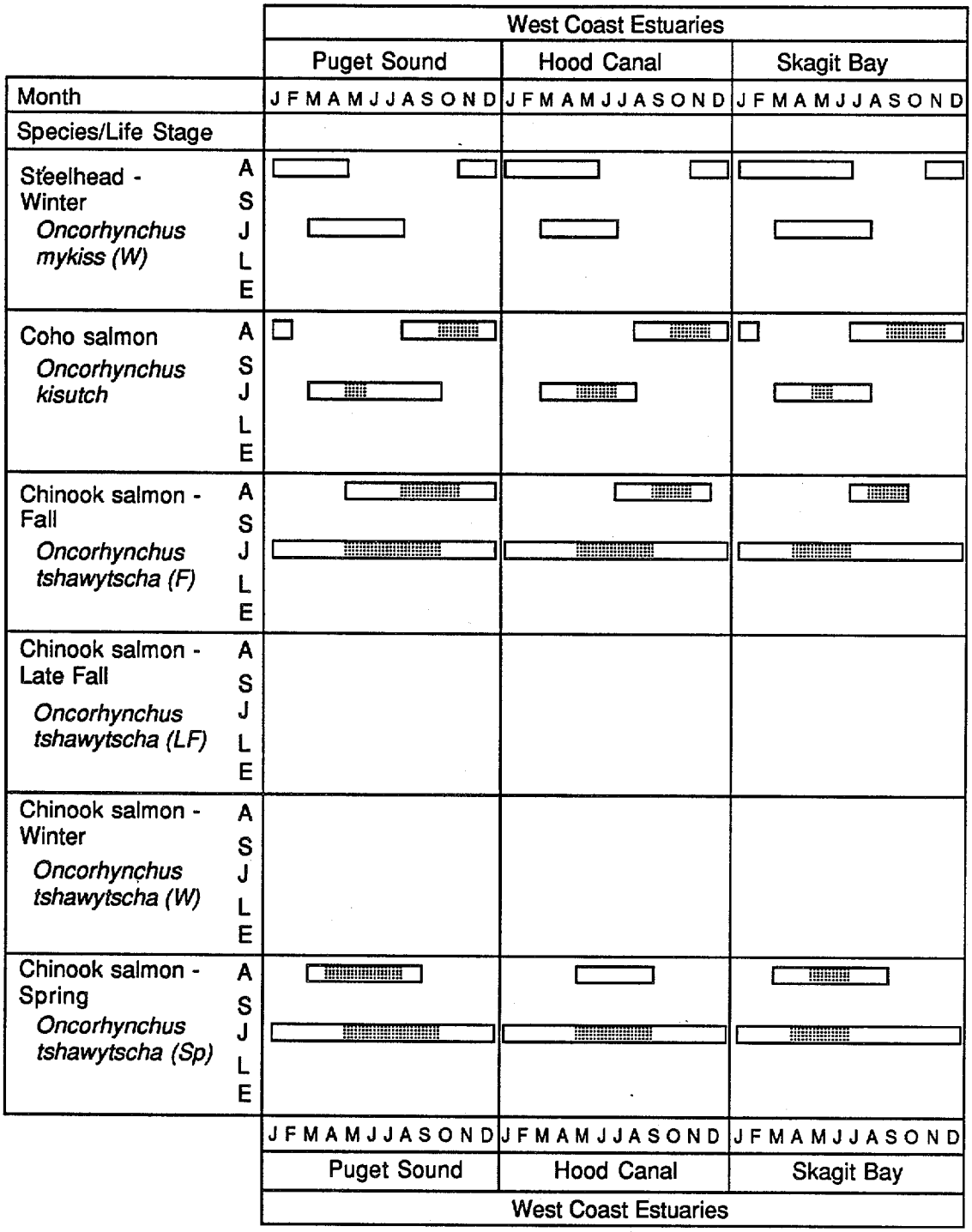
- ▬ Highly Abundant
- ▩ Abundant
- ▭ Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

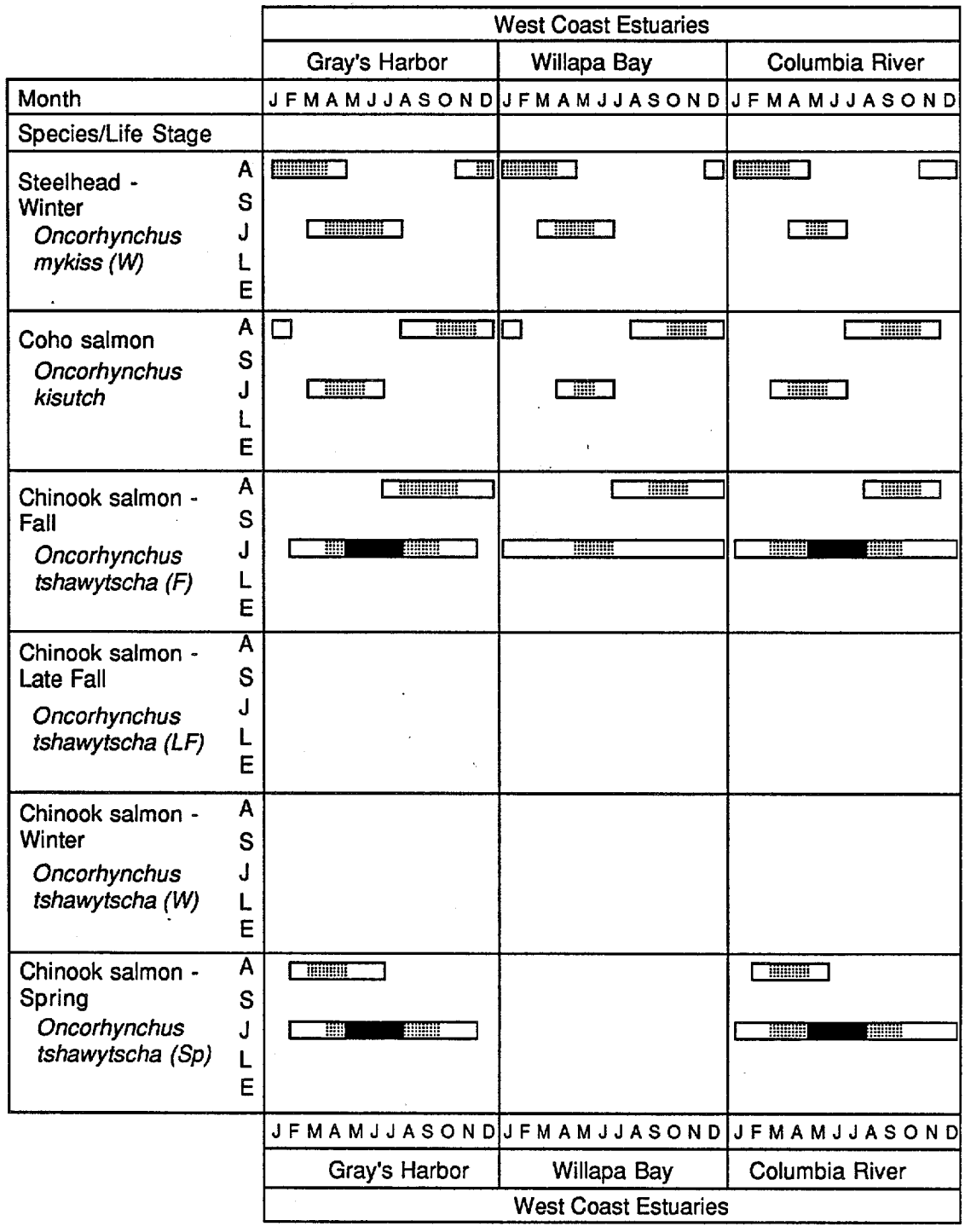
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

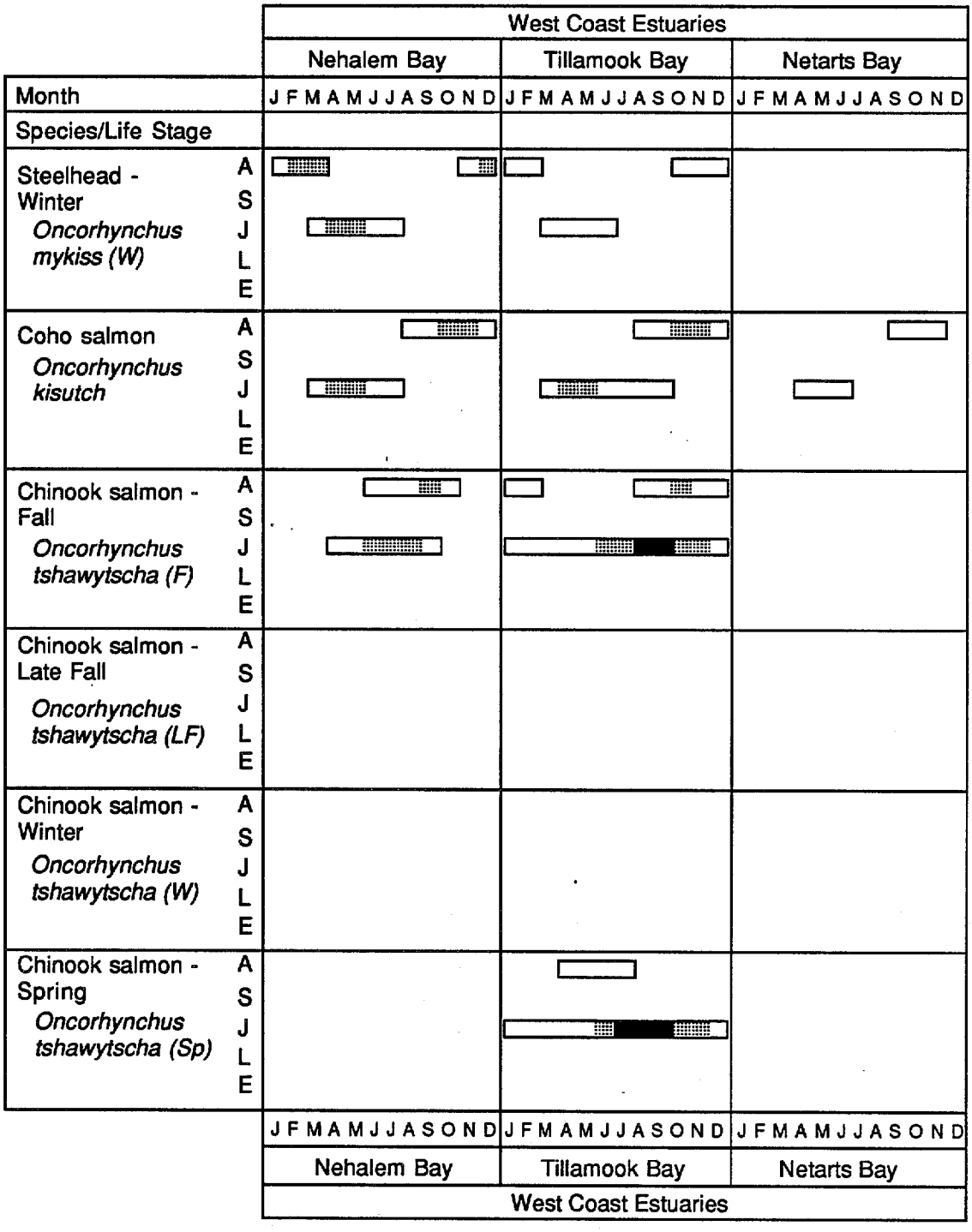
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

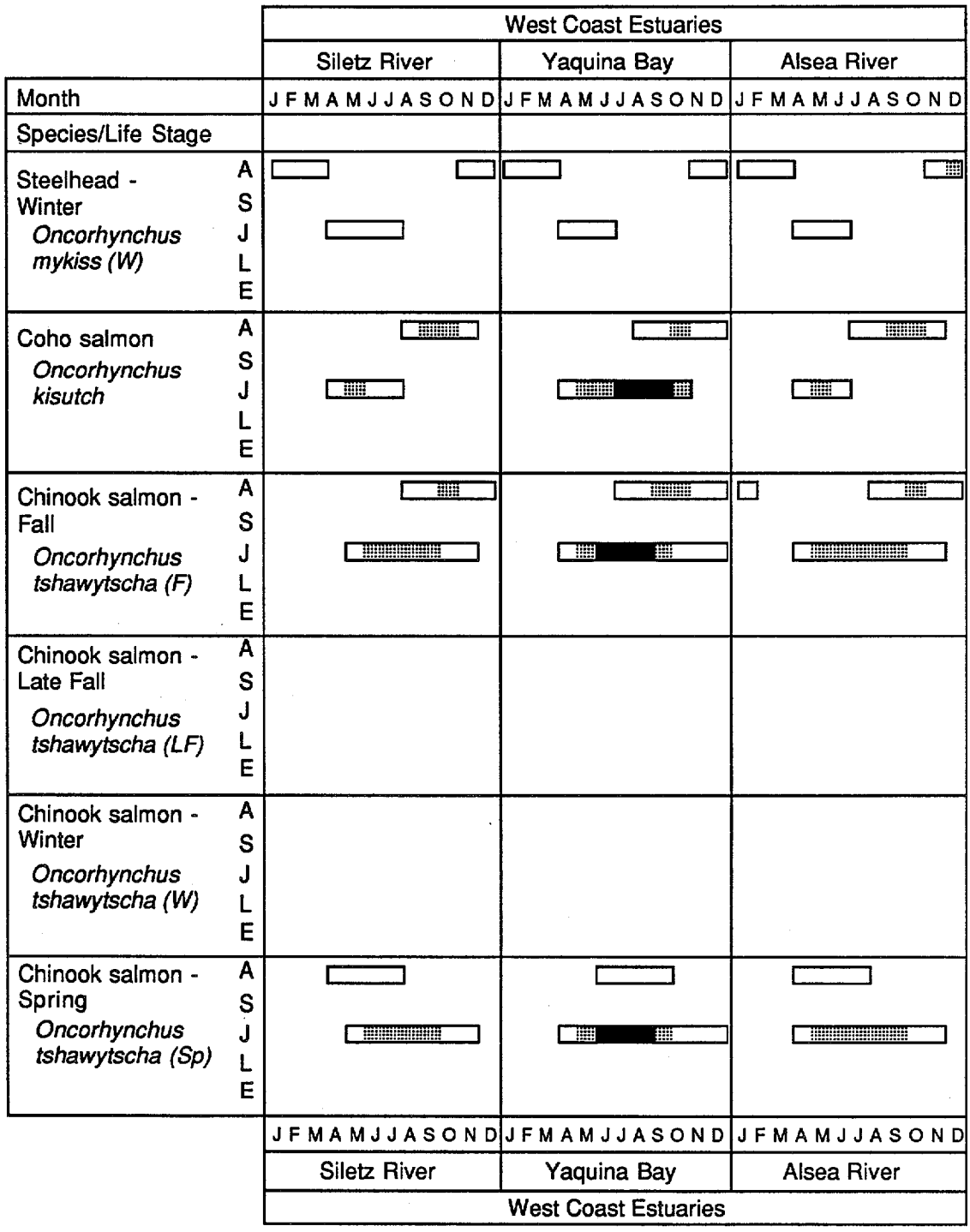
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

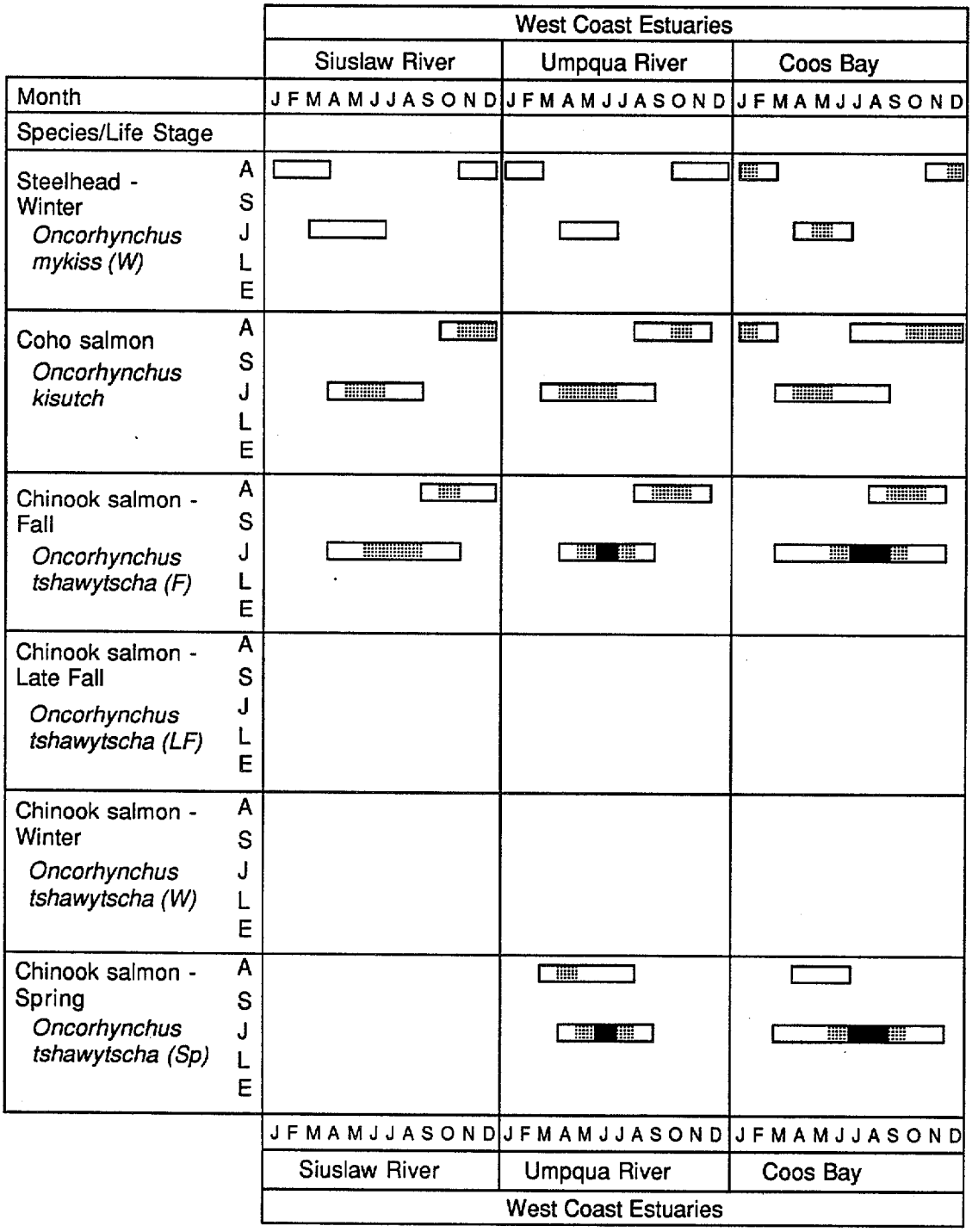
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

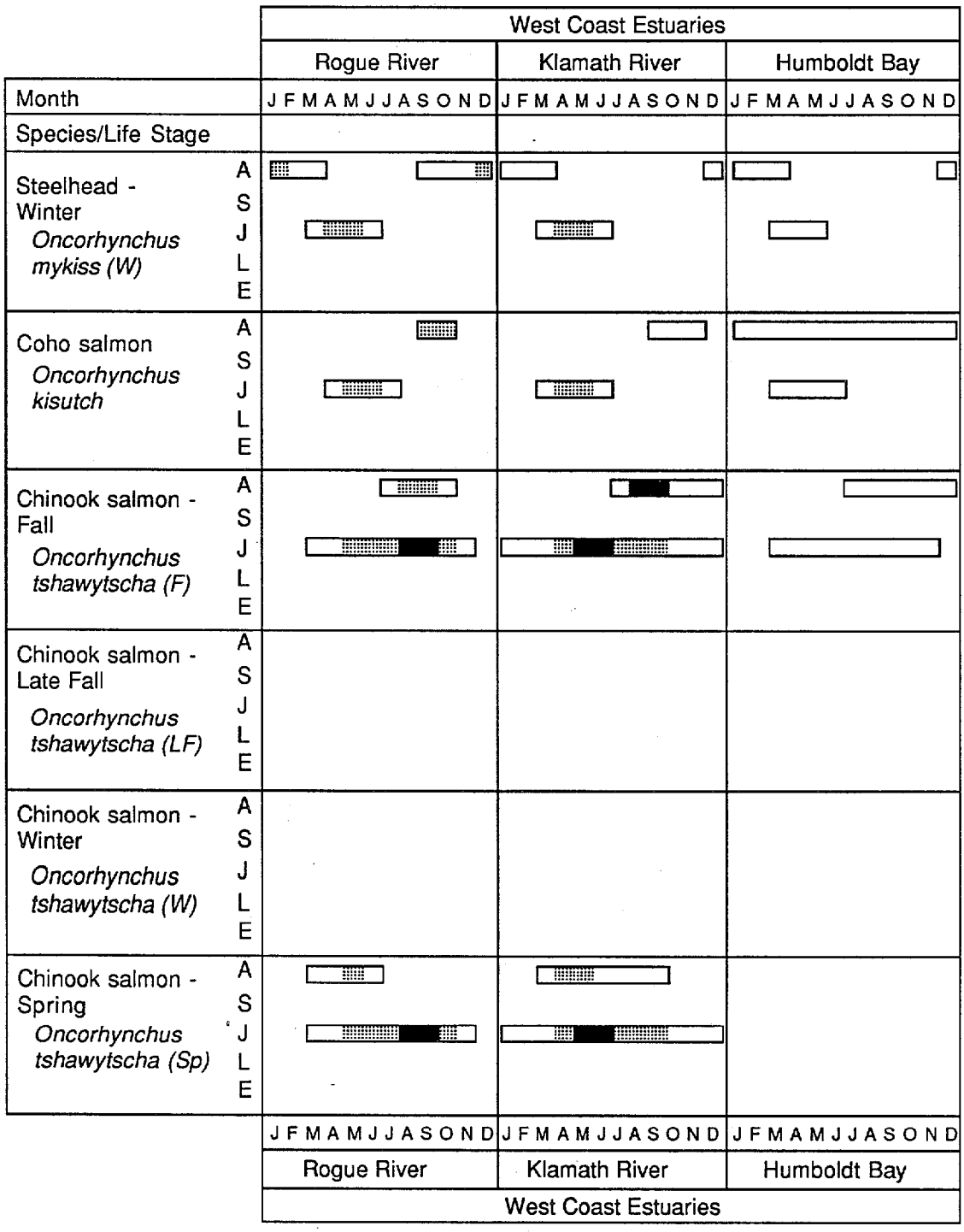
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

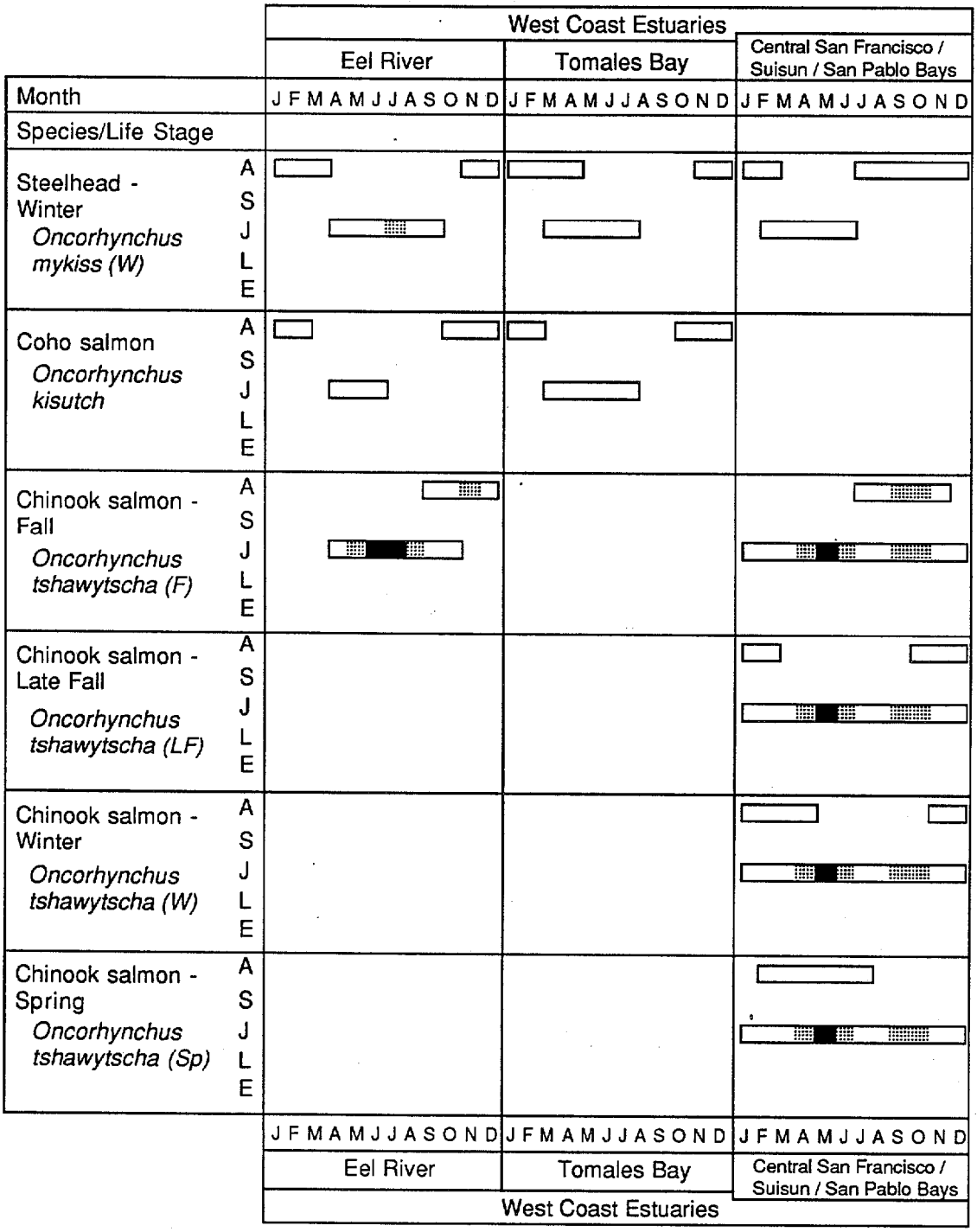
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution Table 3 (continued).

		West Coast Estuaries		
		South San Fran. Bay	Elkhorn Slough	Morro Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Steelhead - Winter *Oncorhynchus mykiss (W)*	A S J L E			
Coho salmon *Oncorhynchus kisutch*	A S J L E			
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A S J L E			
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A S J L E			
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A S J L E			
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Steelhead - Winter *Oncorhynchus mykiss (W)*	A S J L E			
Coho salmon *Oncorhynchus kisutch*	A S J L E			
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A S J L E			
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A S J L E			
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A S J L E			
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution Table 3 (continued).

		West Coast Estuaries		
		Anaheim Bay	Newport Bay	Mission Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Steelhead - Winter *Oncorhynchus mykiss (W)*	A S J L E			
Coho salmon *Oncorhynchus kisutch*	A S J L E			
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A S J L E			
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A S J L E			
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A S J L E			
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Anaheim Bay	Newport Bay	Mission Bay
		West Coast Estuaries		

Relative Abundance

- ■ Highly Abundant
- ▒ Abundant
- ▭ Common
- Blank Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries	
		San Diego Bay	Tijuana Estuary
Month		J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage			
Steelhead - Winter *Oncorhynchus mykiss (W)*	A S J L E		
Coho salmon *Oncorhynchus kisutch*	A S J L E		
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A S J L E		
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A S J L E		
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A S J L E		
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A S J L E		
		J F M A M J J A S O N D	J F M A M J J A S O N D
		San Diego Bay	Tijuana Estuary
		West Coast Estuaries	

Relative Abundance

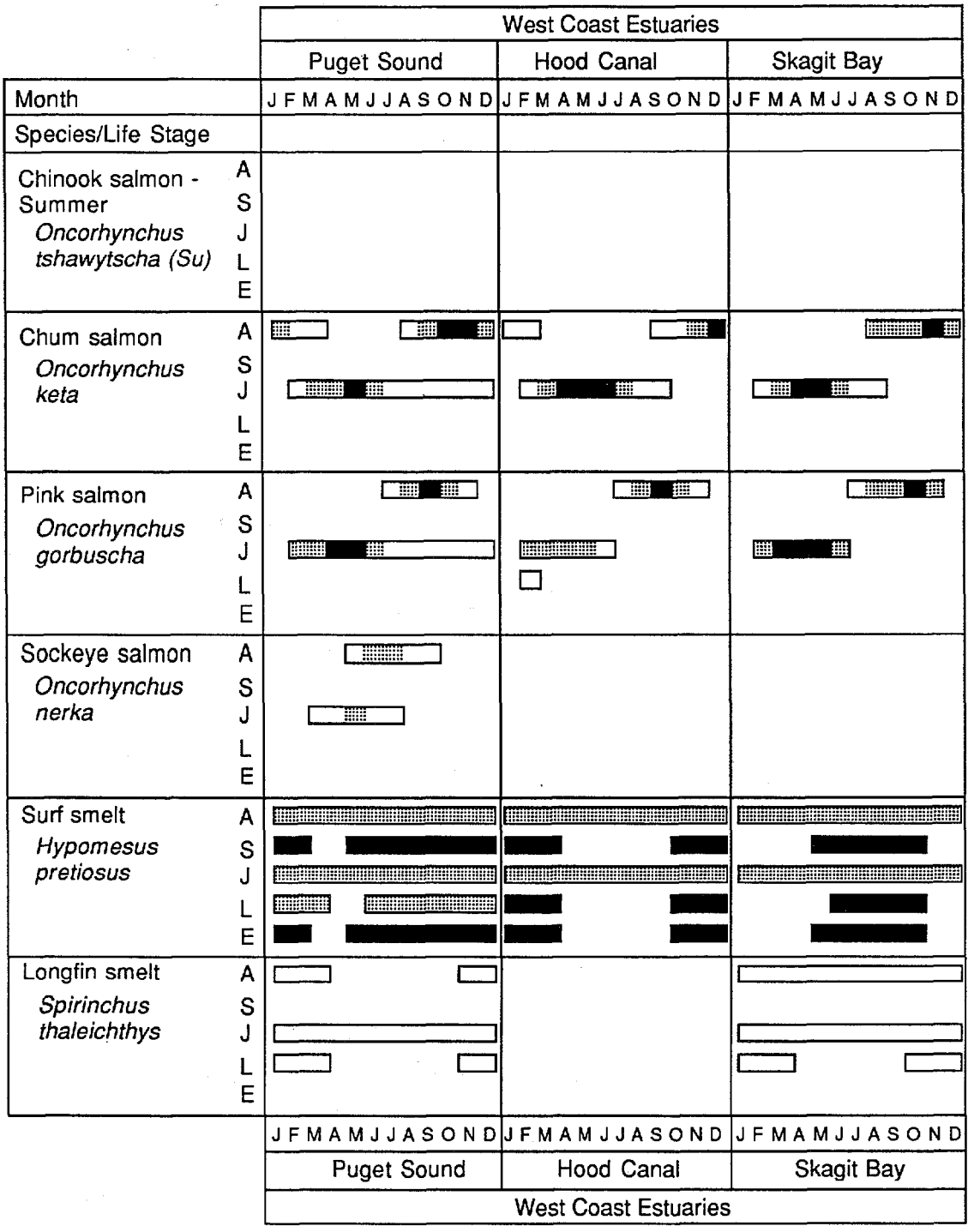
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

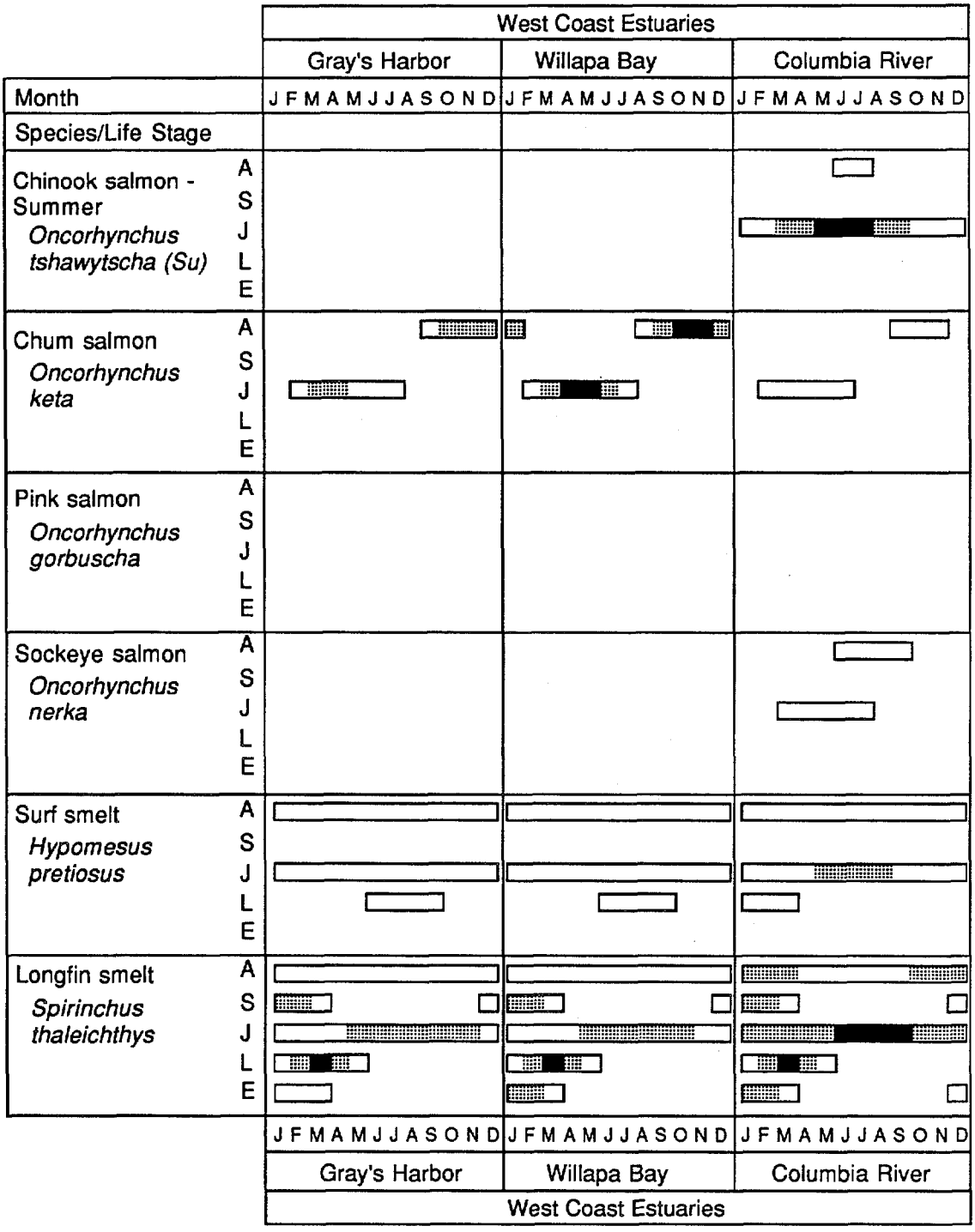
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

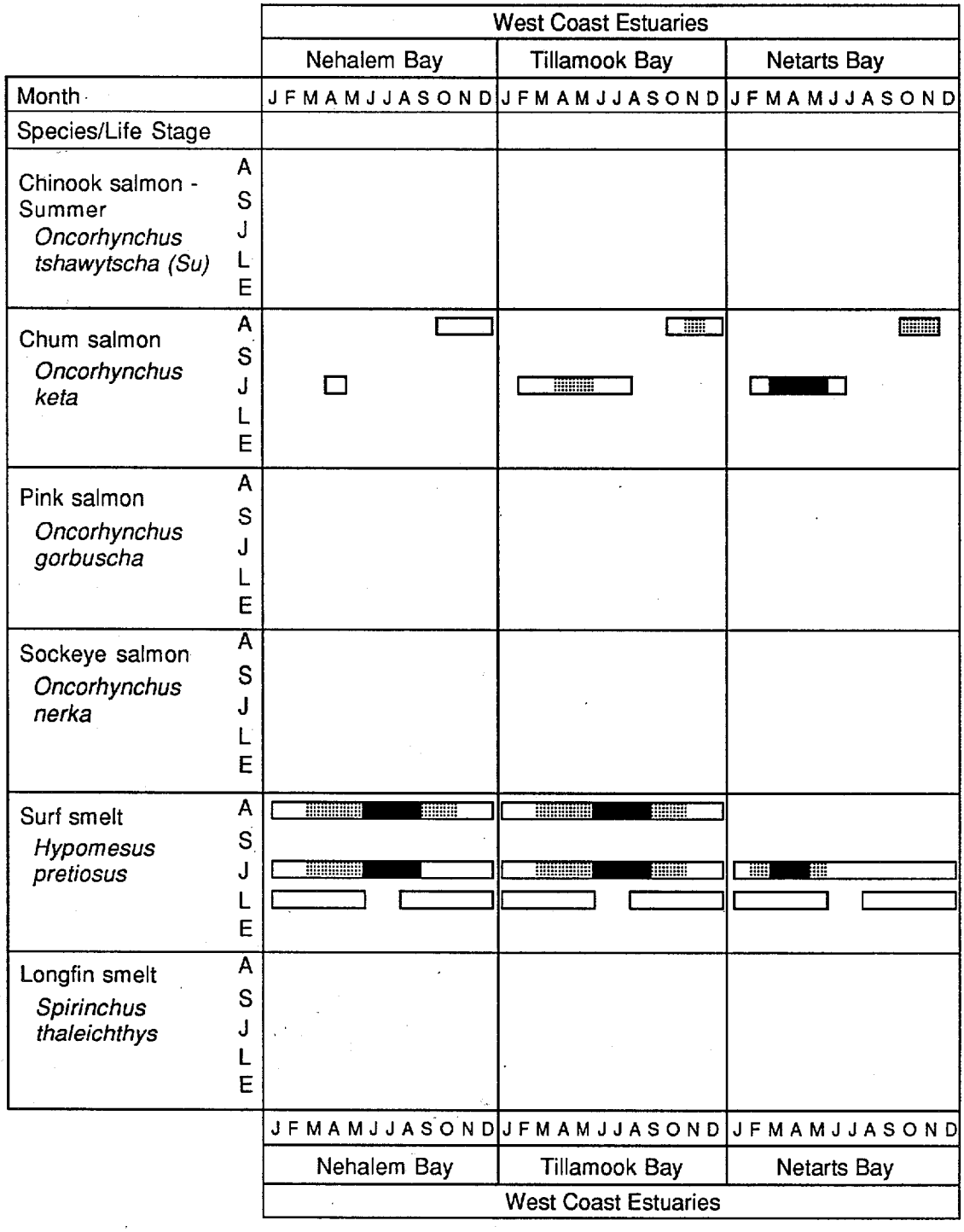
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

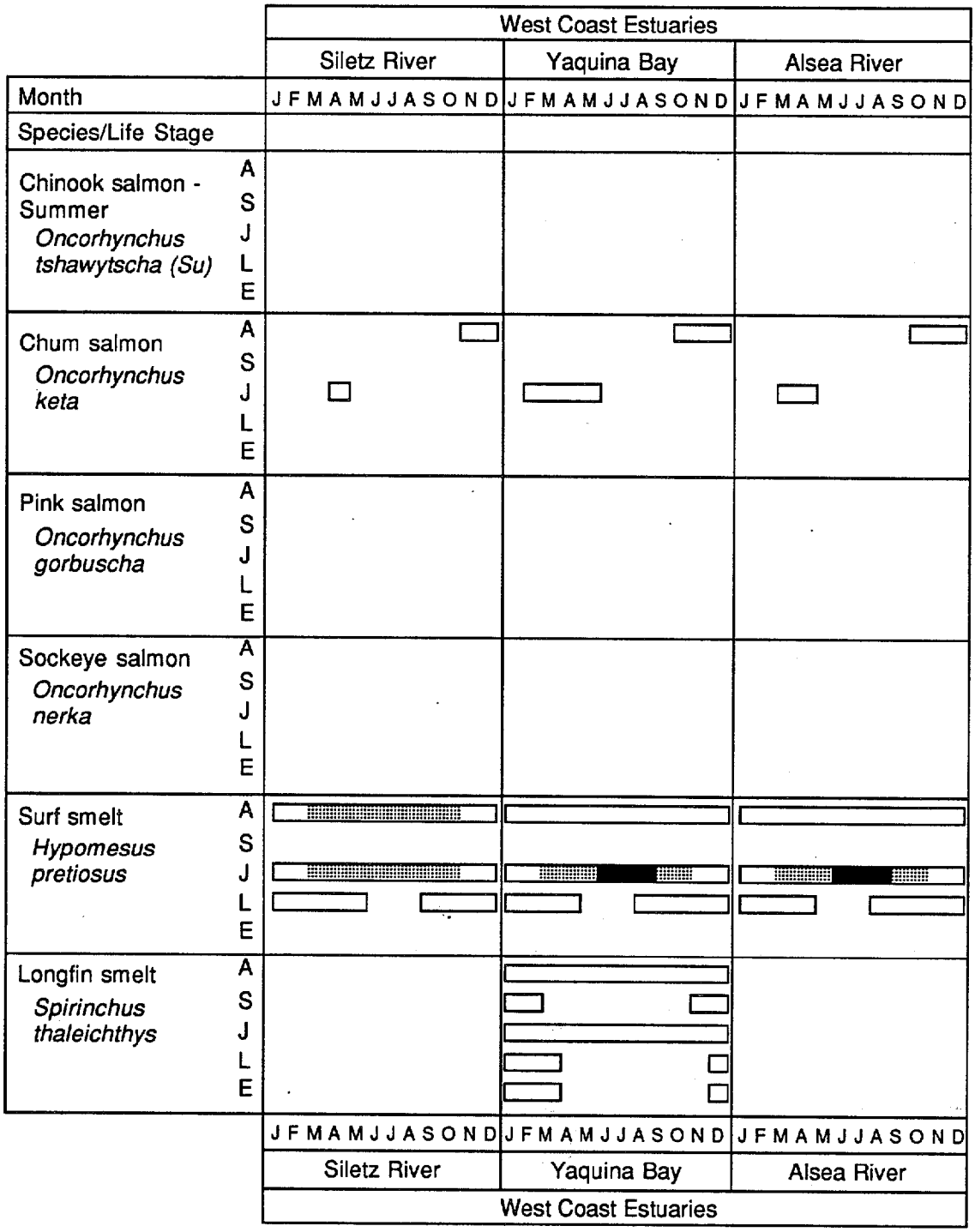
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

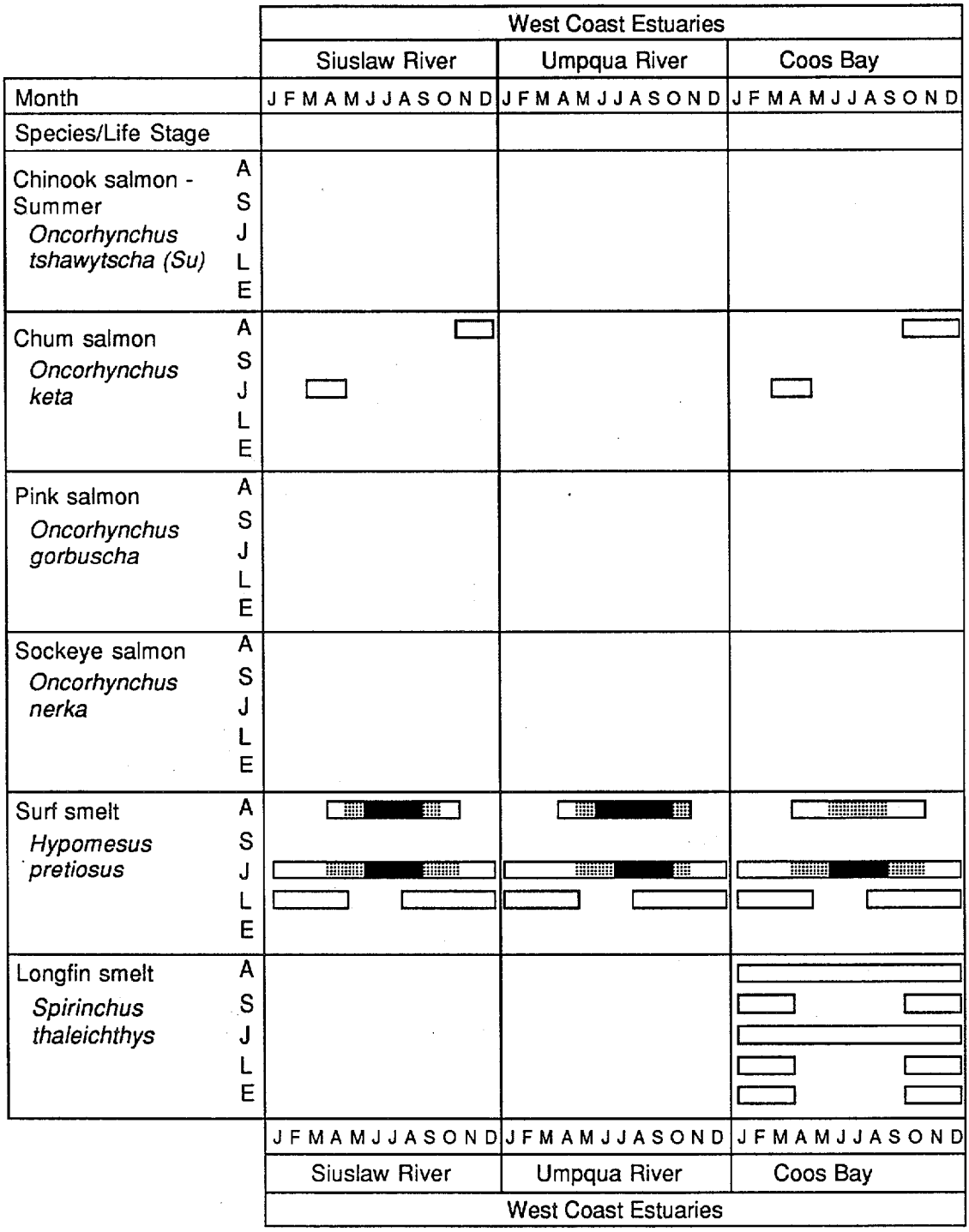
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

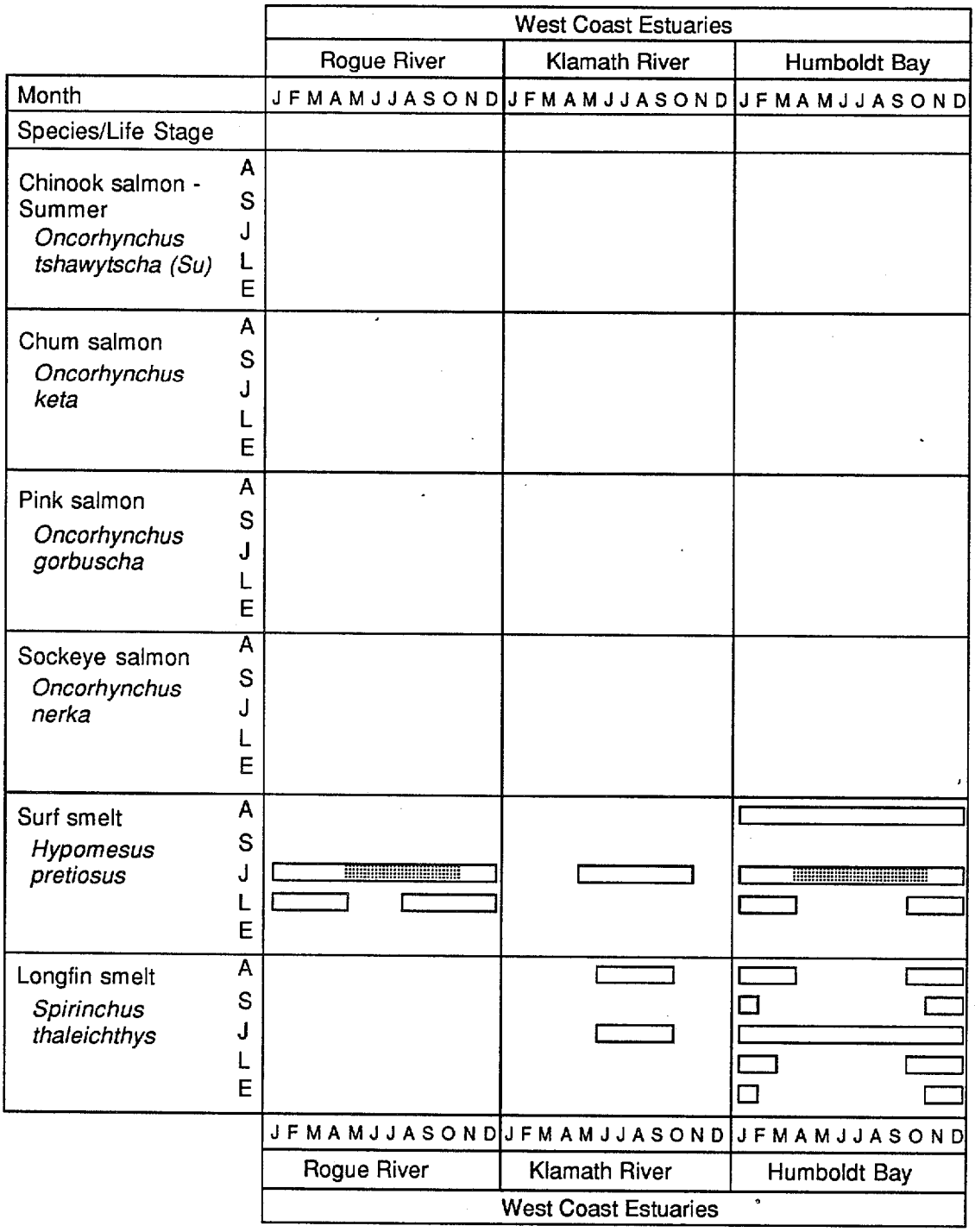
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

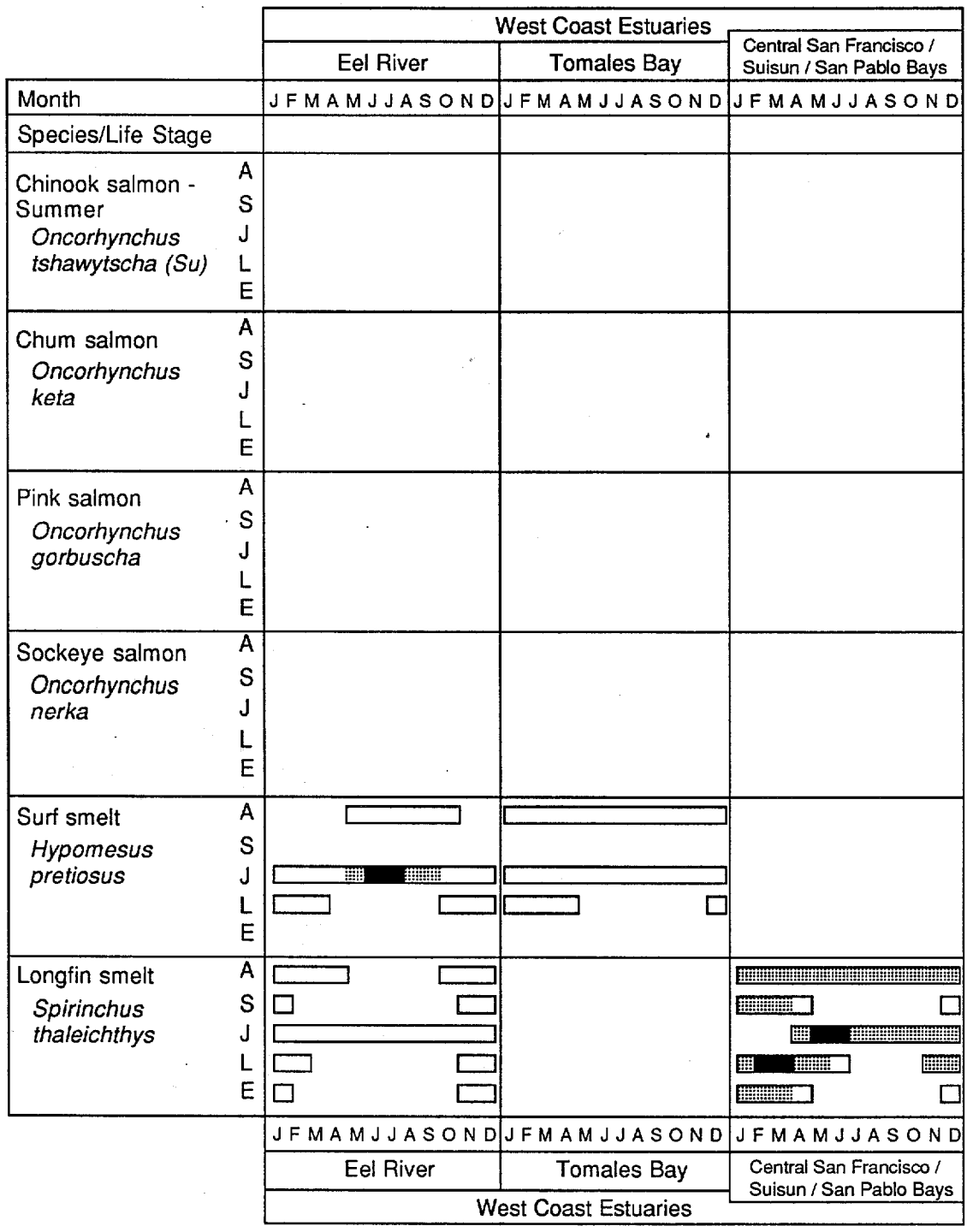
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

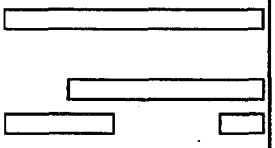
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		South San Fran. Bay	Elkhorn Slough	Morro Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A S J L E			
Chum salmon *Oncorhynchus keta*	A S J L E			
Pink salmon *Oncorhynchus gorbuscha*	A S J L E			
Sockeye salmon *Oncorhynchus nerka*	A S J L E			
Surf smelt *Hypomesus pretiosus*	A S J L E			
Longfin smelt *Spirinchus thaleichthys*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A S J L E			
Chum salmon *Oncorhynchus keta*	A S J L E			
Pink salmon *Oncorhynchus gorbuscha*	A S J L E			
Sockeye salmon *Oncorhynchus nerka*	A S J L E			
Surf smelt *Hypomesus pretiosus*	A S J L E			
Longfin smelt *Spirinchus thaleichthys*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Santa Monica Bay	San Pedro Bay	Alamitos Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Anaheim Bay	Newport Bay	Mission Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A S J L E			
Chum salmon *Oncorhynchus keta*	A S J L E			
Pink salmon *Oncorhynchus gorbuscha*	A S J L E			
Sockeye salmon *Oncorhynchus nerka*	A S J L E			
Surf smelt *Hypomesus pretiosus*	A S J L E			
Longfin smelt *Spirinchus thaleichthys*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Anaheim Bay	Newport Bay	Mission Bay
		West Coast Estuaries		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries	
		San Diego Bay	Tijuana Estuary
Month		J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage			
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A S J L E		
Chum salmon *Oncorhynchus keta*	A S J L E		
Pink salmon *Oncorhynchus gorbuscha*	A S J L E		
Sockeye salmon *Oncorhynchus nerka*	A S J L E		
Surf smelt *Hypomesus pretiosus*	A S J L E		
Longfin smelt *Spirinchus thaleichthys*	A S J L E		
		J F M A M J J A S O N D	J F M A M J J A S O N D
		San Diego Bay	Tijuana Estuary
		West Coast Estuaries	

Relative Abundance

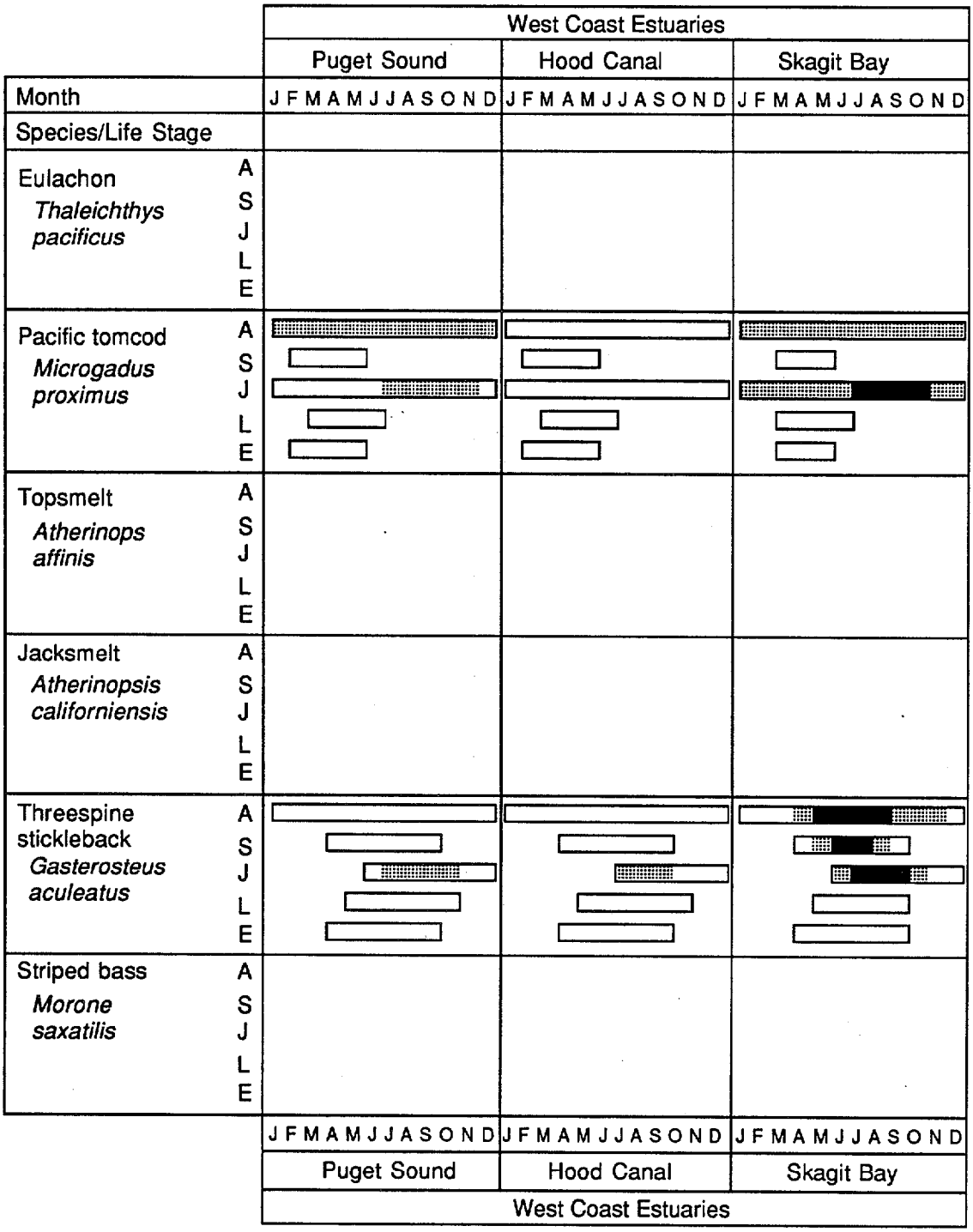
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

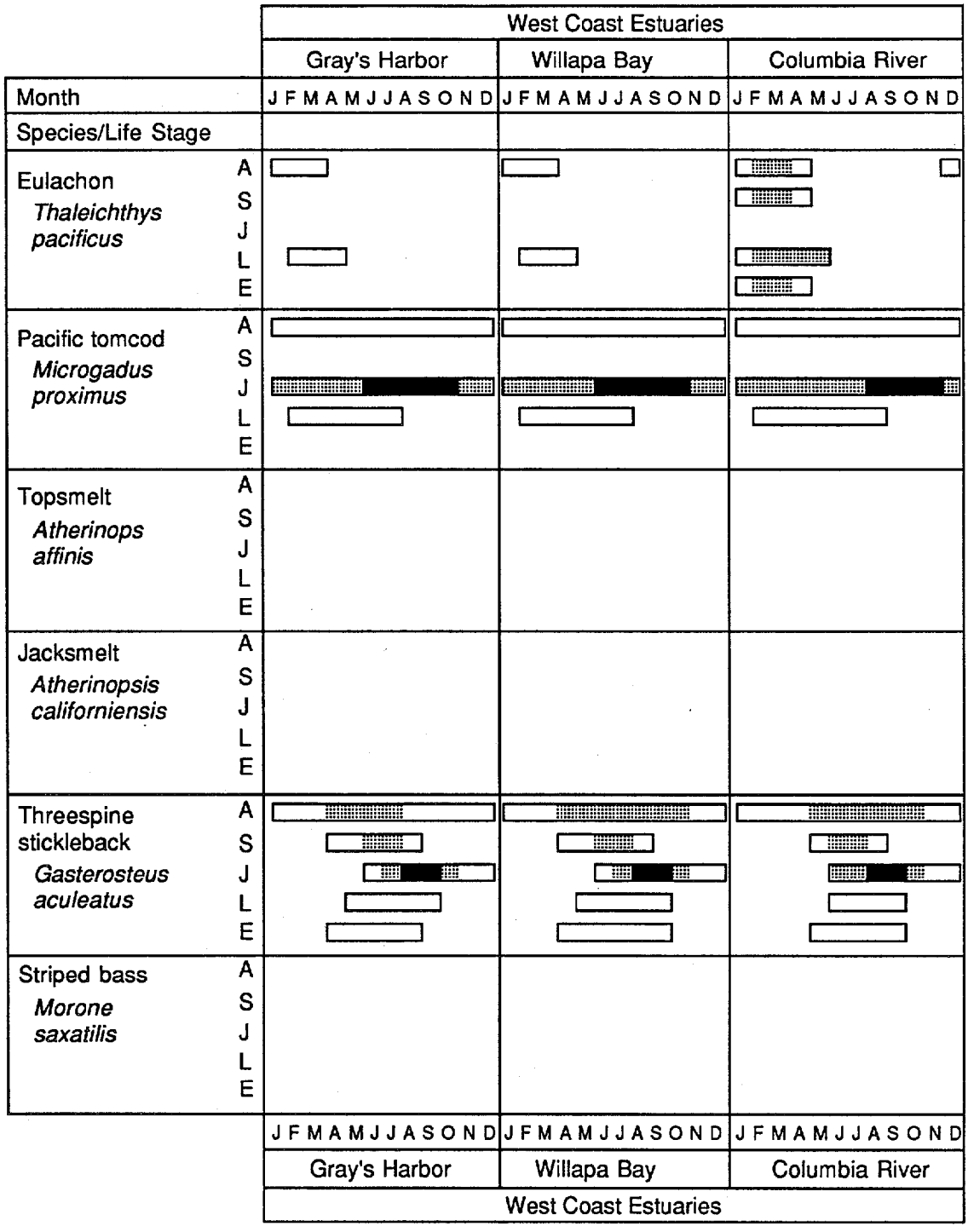
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

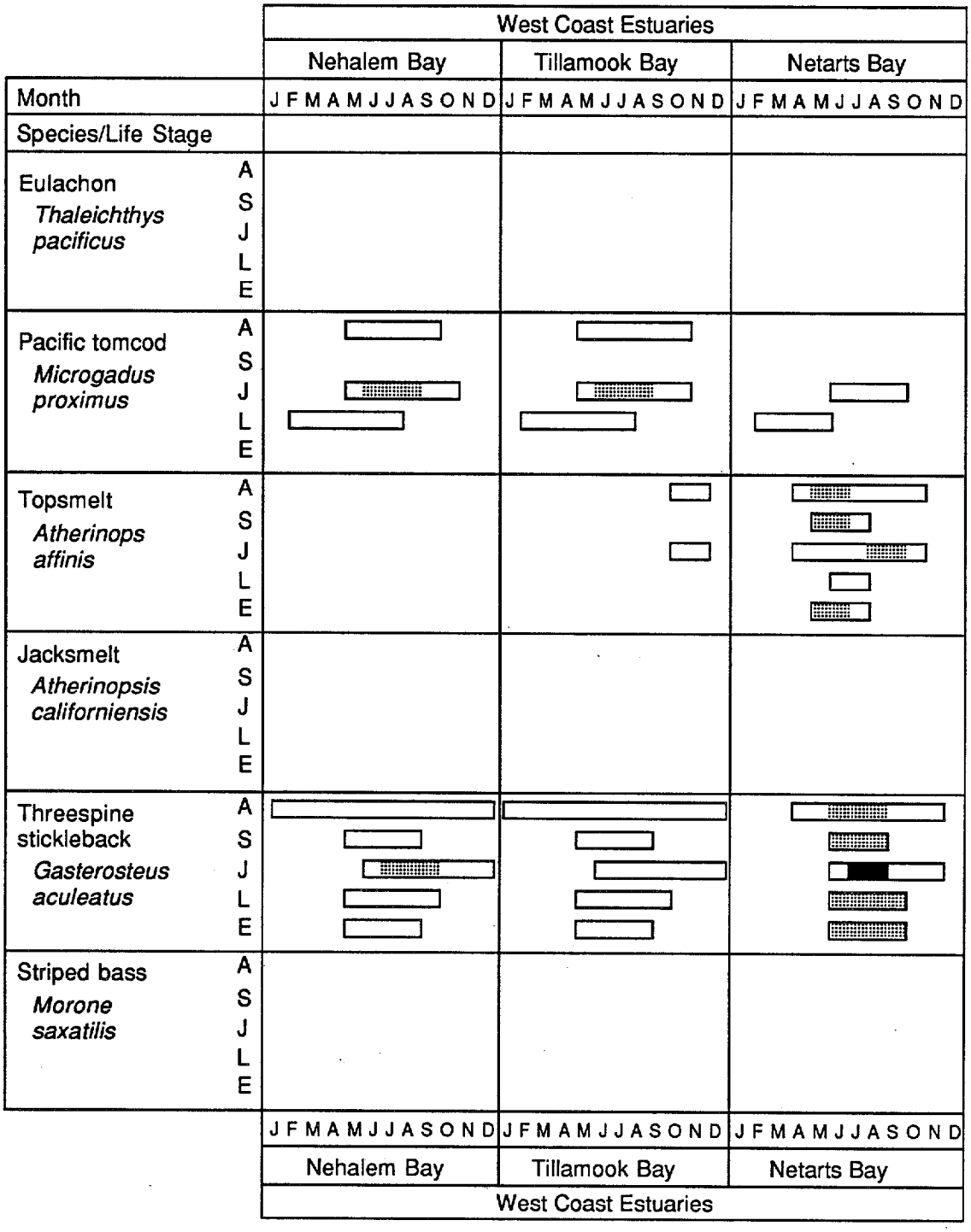
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

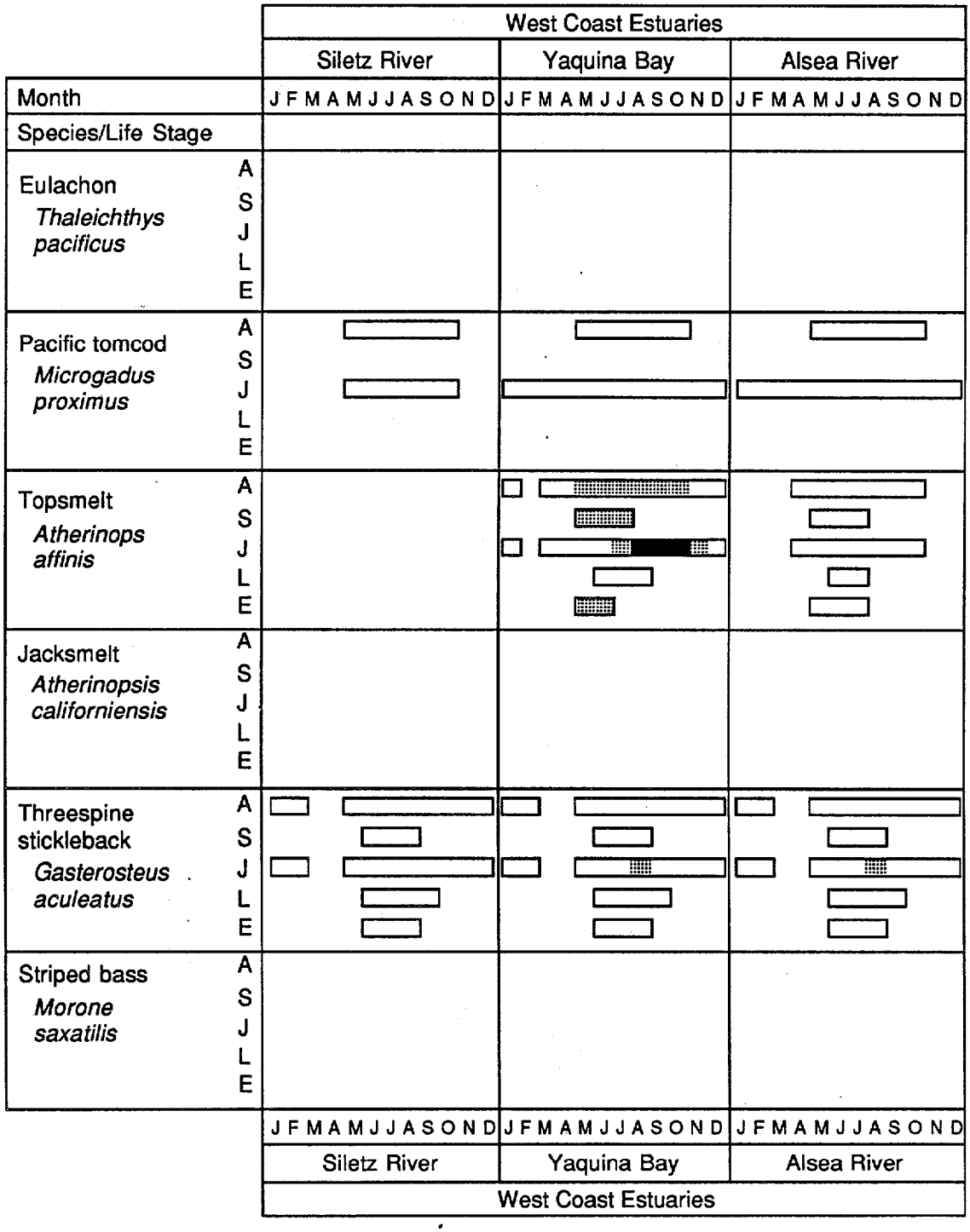
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

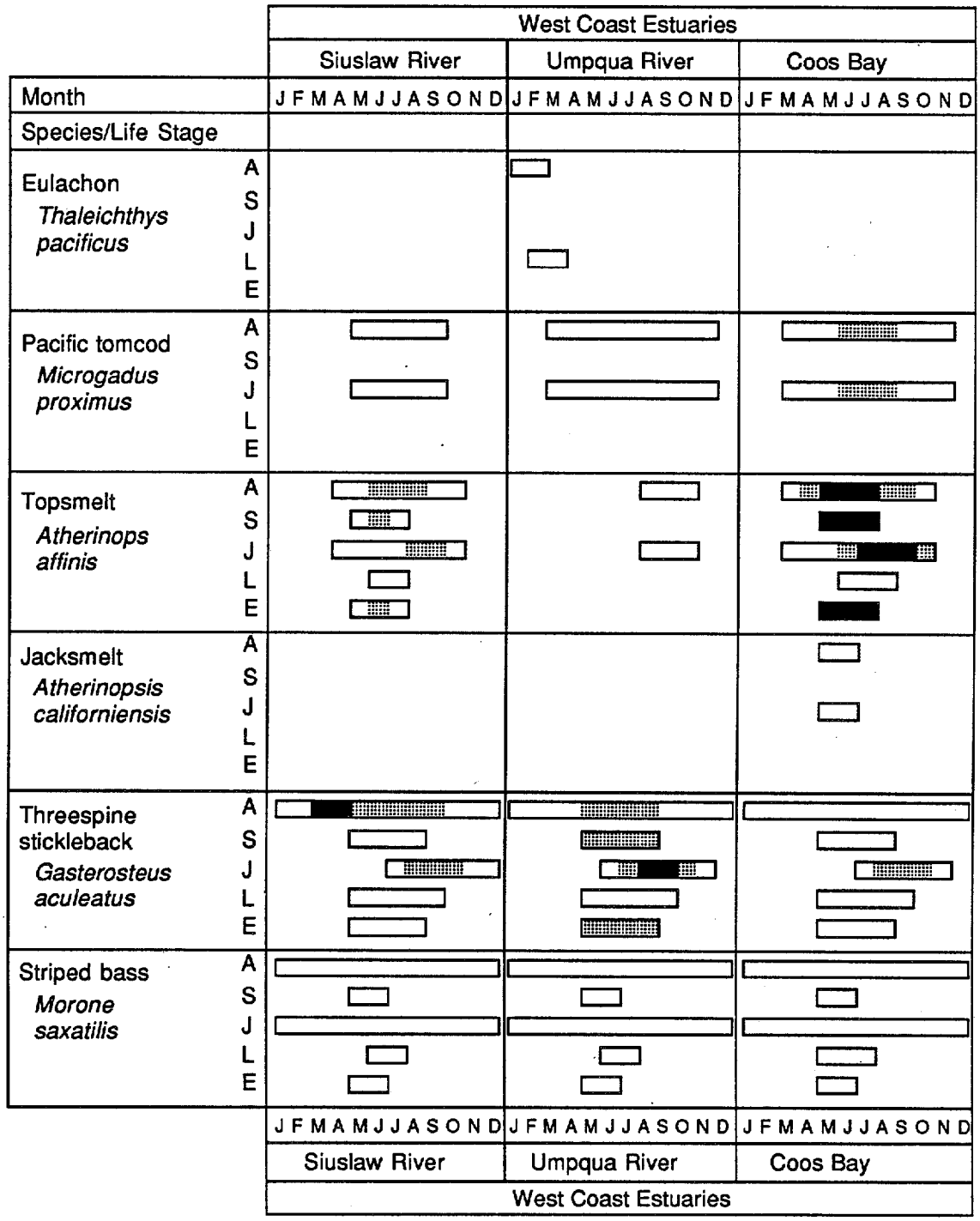
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

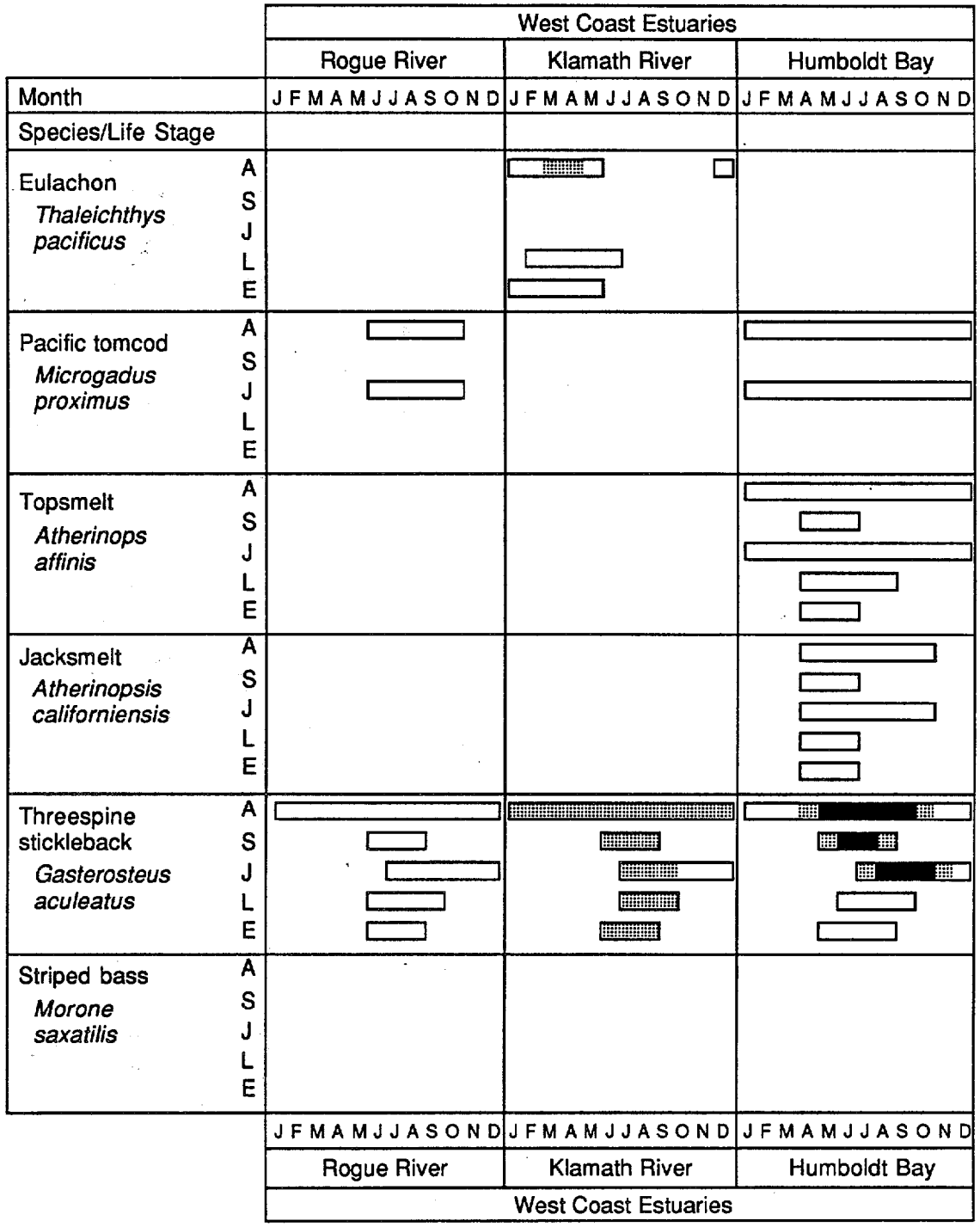
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

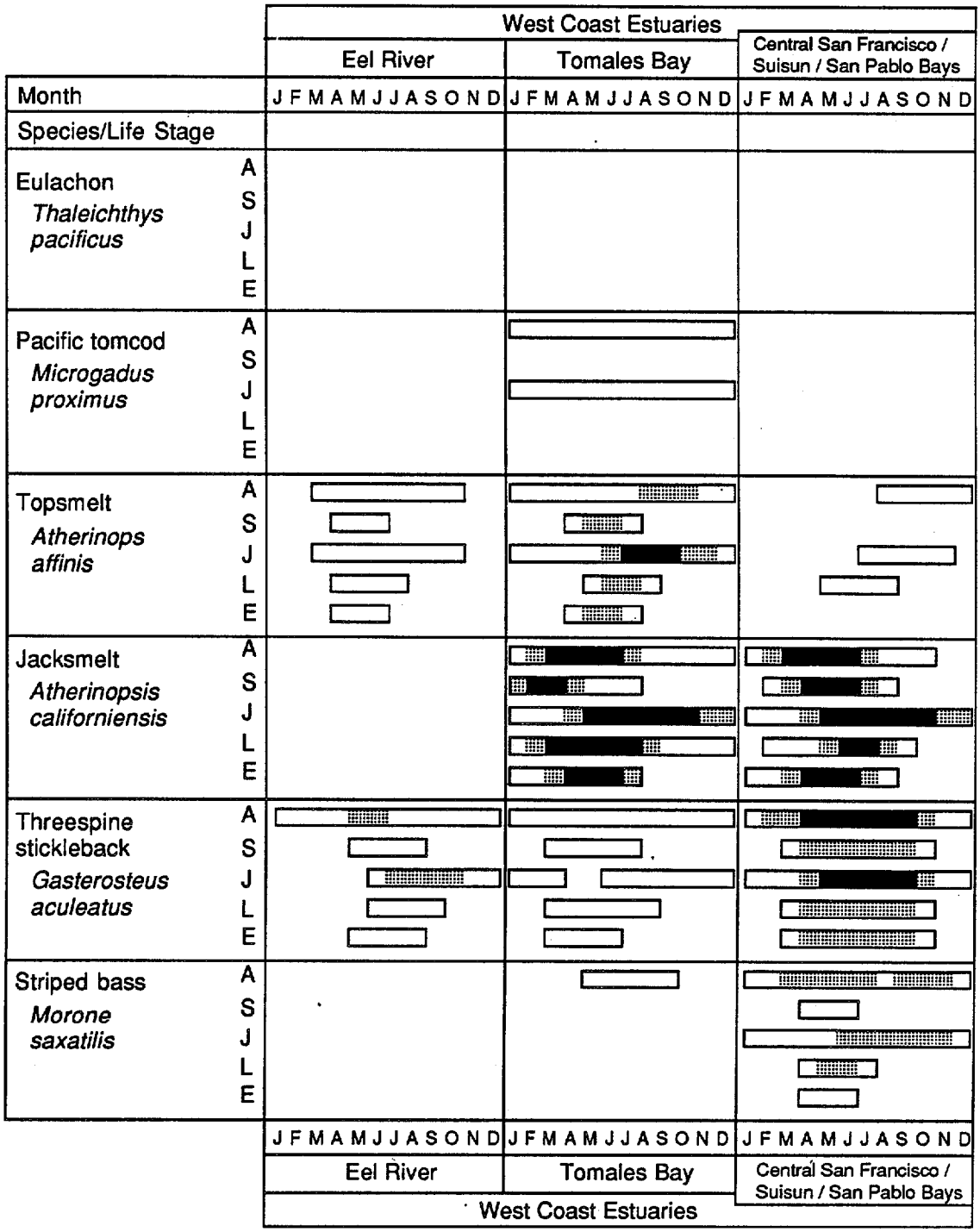
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

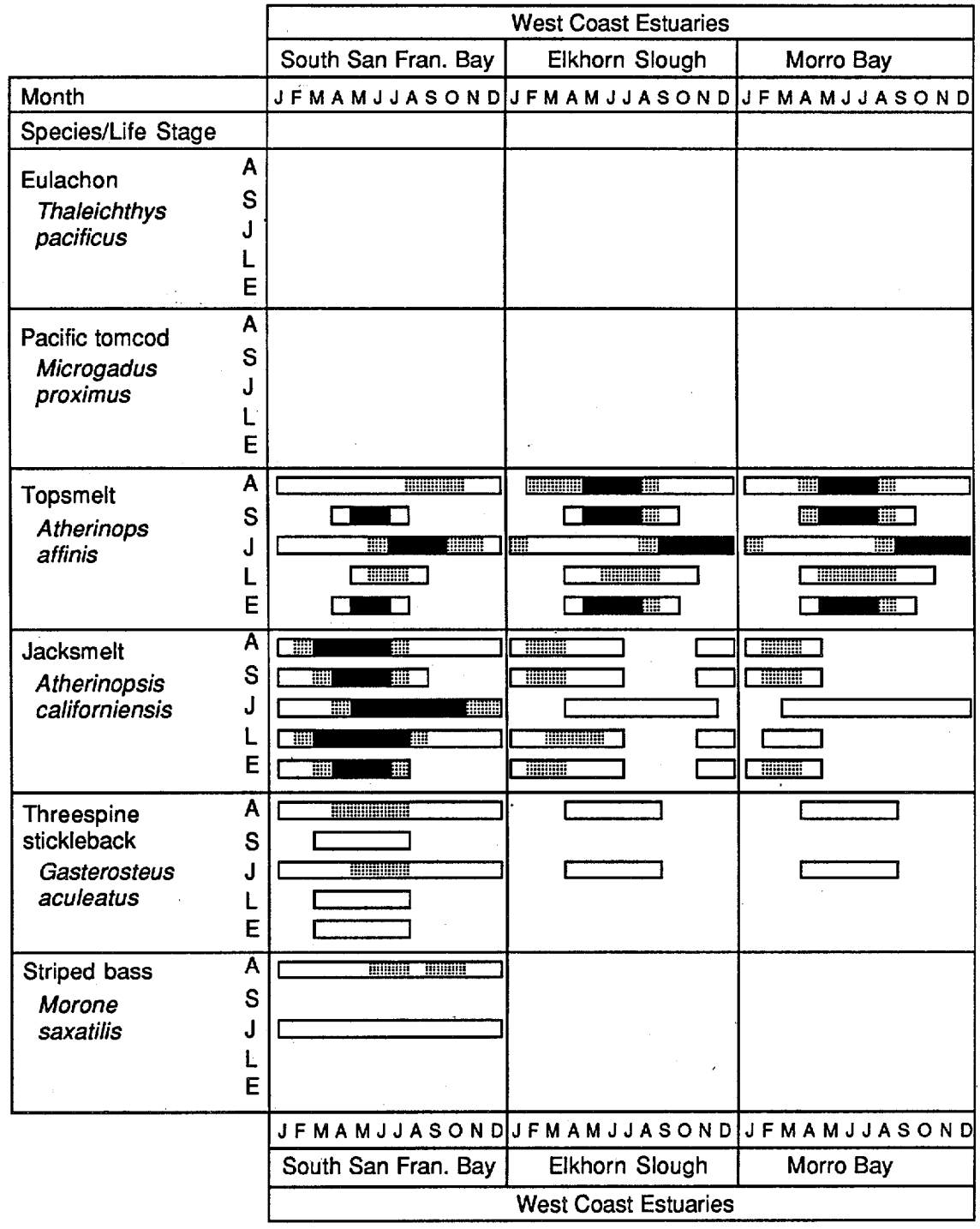
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

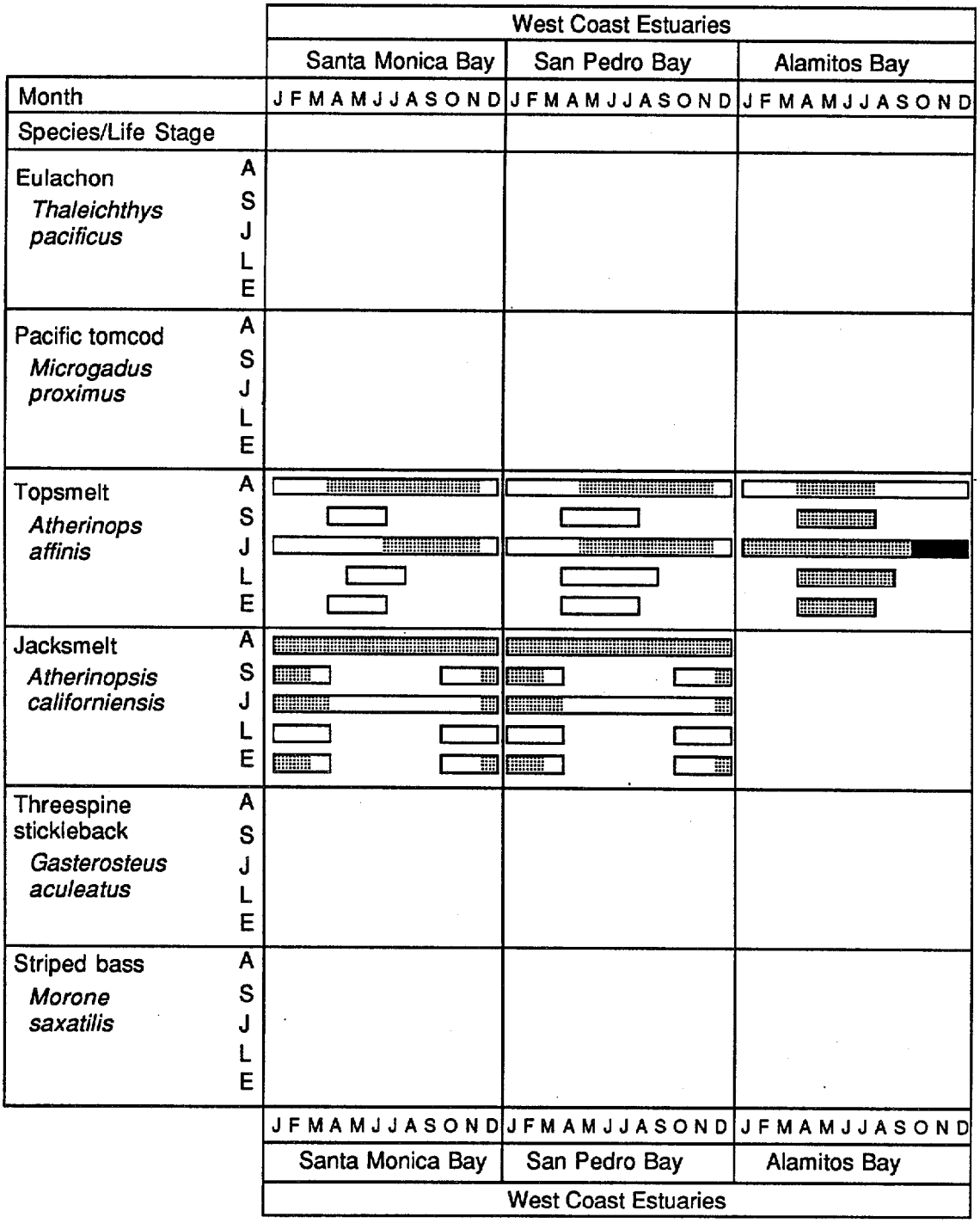
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

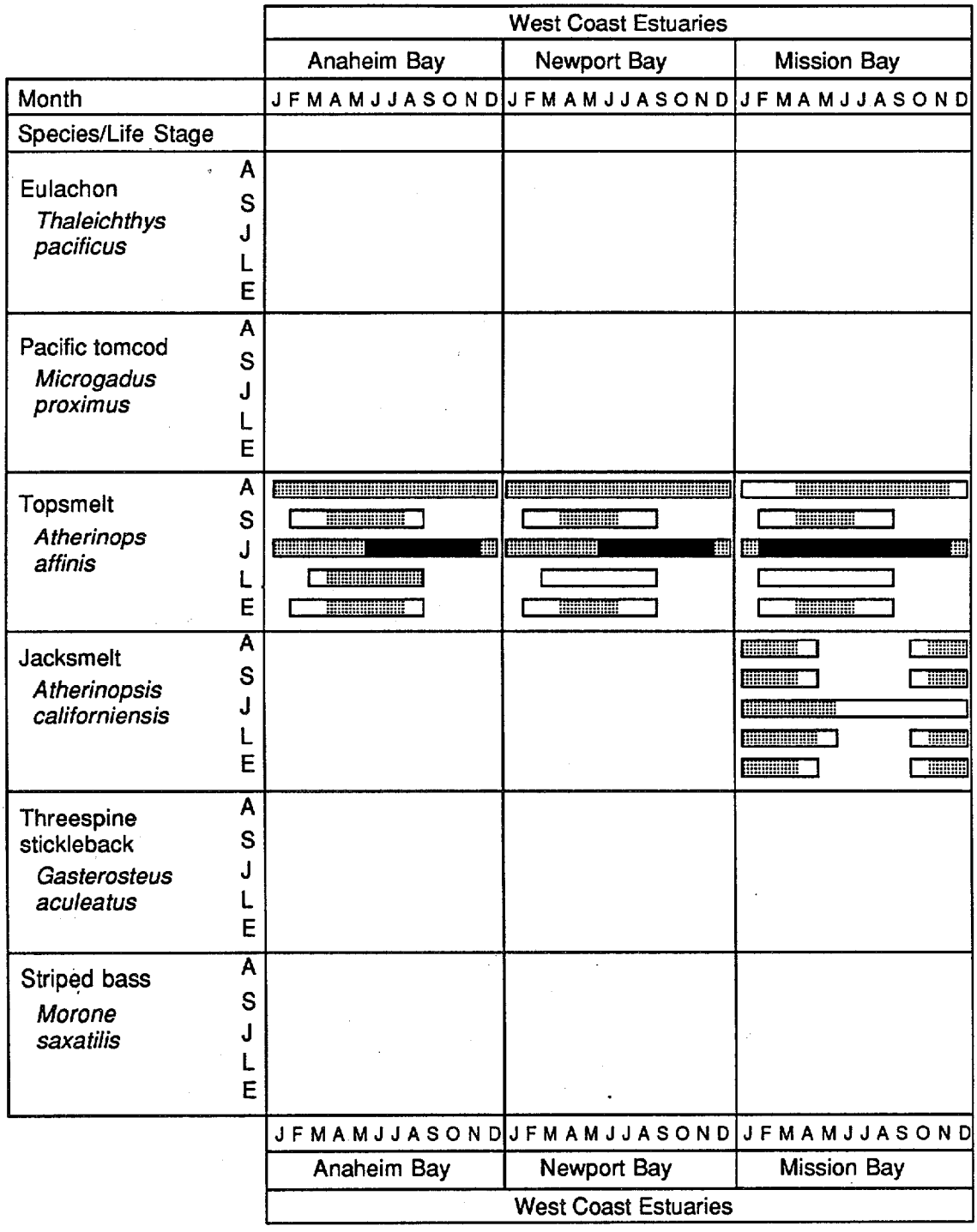
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

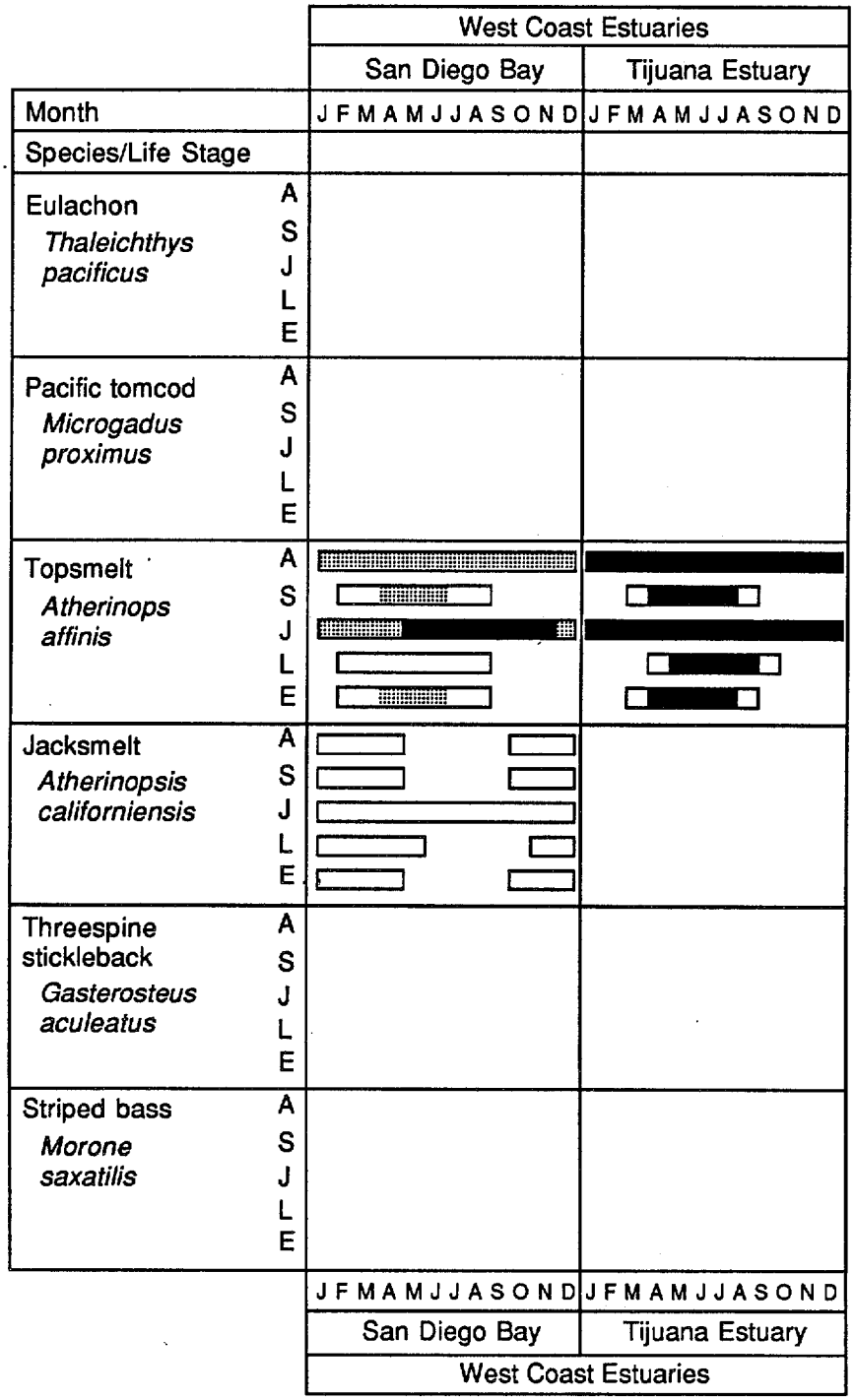
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

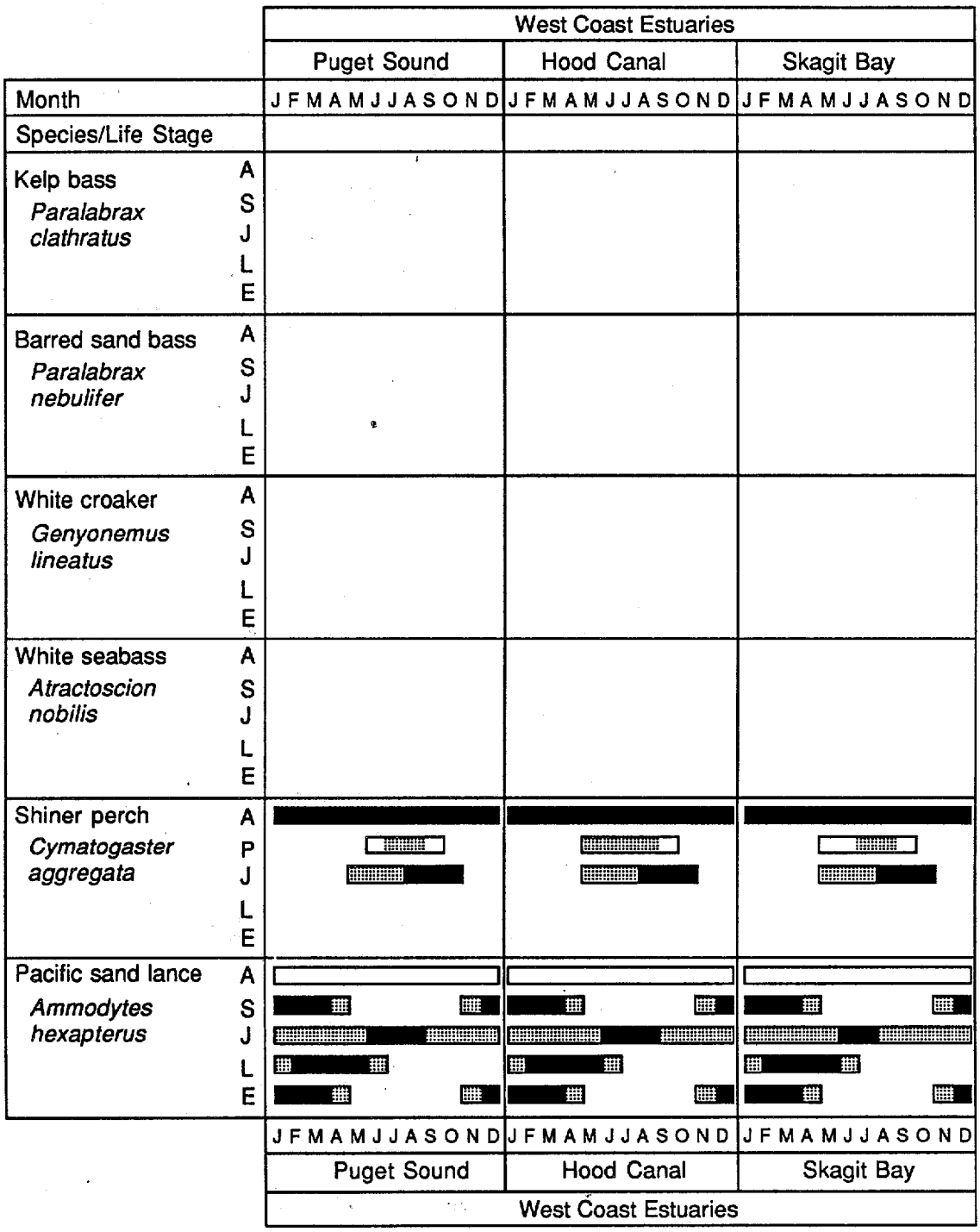
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

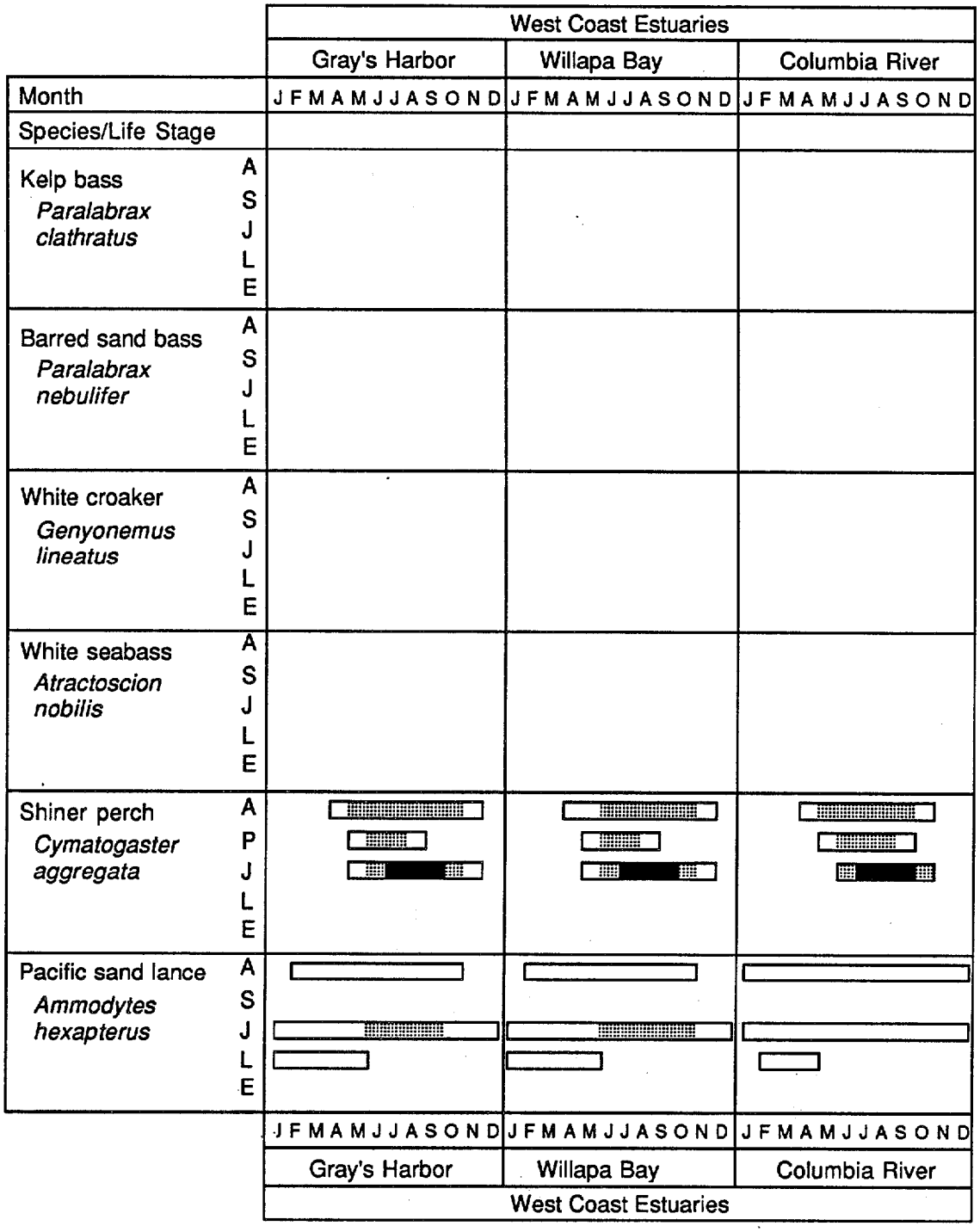
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

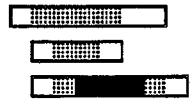
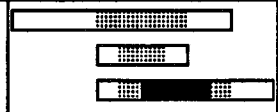
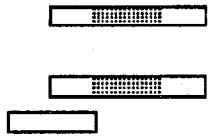
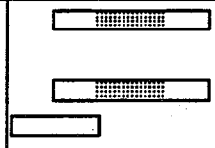
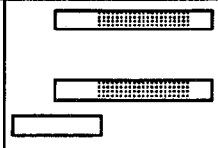
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).

		West Coast Estuaries		
		Nehalem Bay	Tillamook Bay	Netarts Bay
Month		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Species/Life Stage				
Kelp bass *Paralabrax clathratus*	A S J L E			
Barred sand bass *Paralabrax nebulifer*	A S J L E			
White croaker *Genyonemus lineatus*	A S J L E			
White seabass *Atractoscion nobilis*	A S J L E			
Shiner perch *Cymatogaster aggregata*	A P J L E			
Pacific sand lance *Ammodytes hexapterus*	A S J L E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Nehalem Bay	Tillamook Bay	Netarts Bay
		West Coast Estuaries		

Relative Abundance

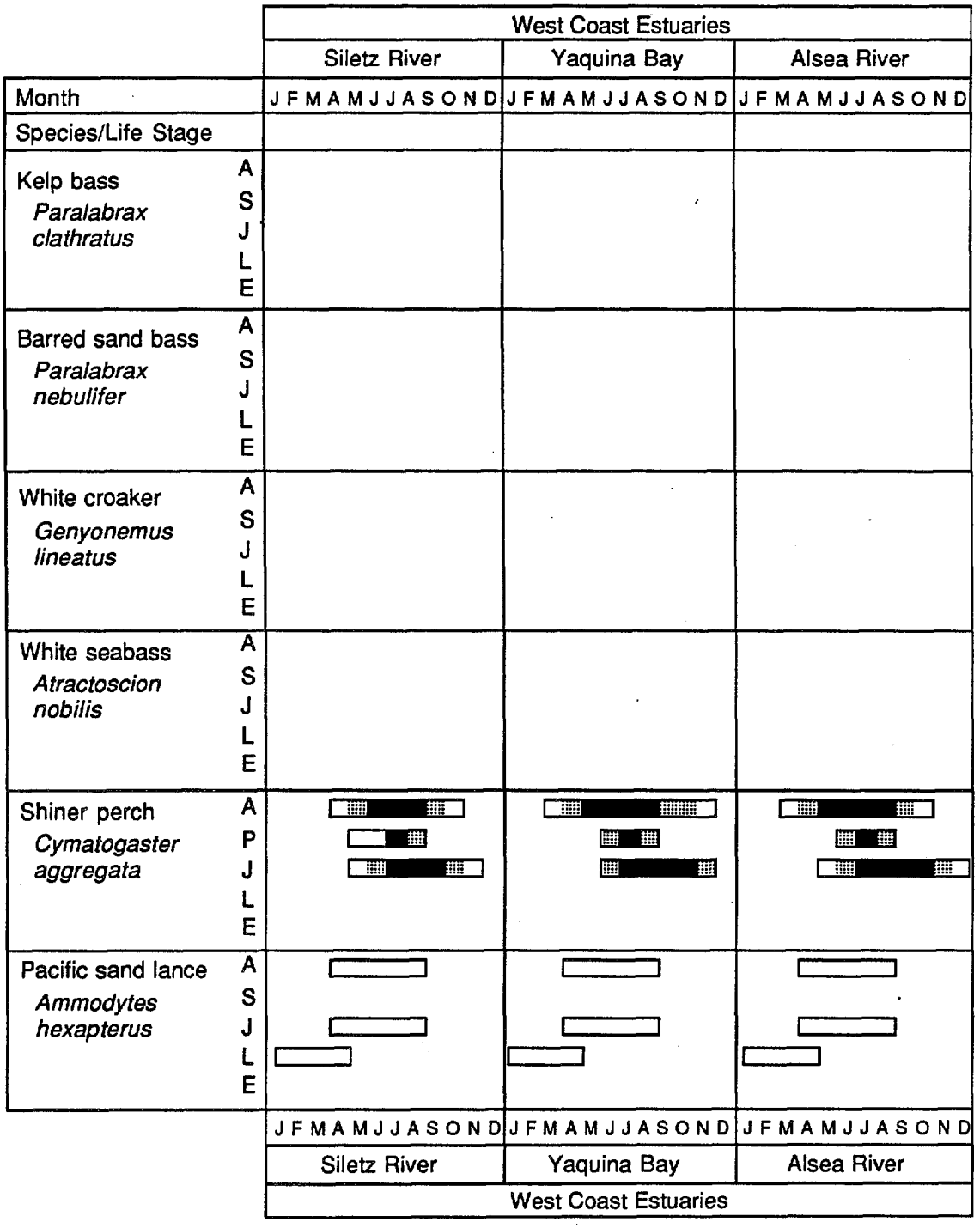
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

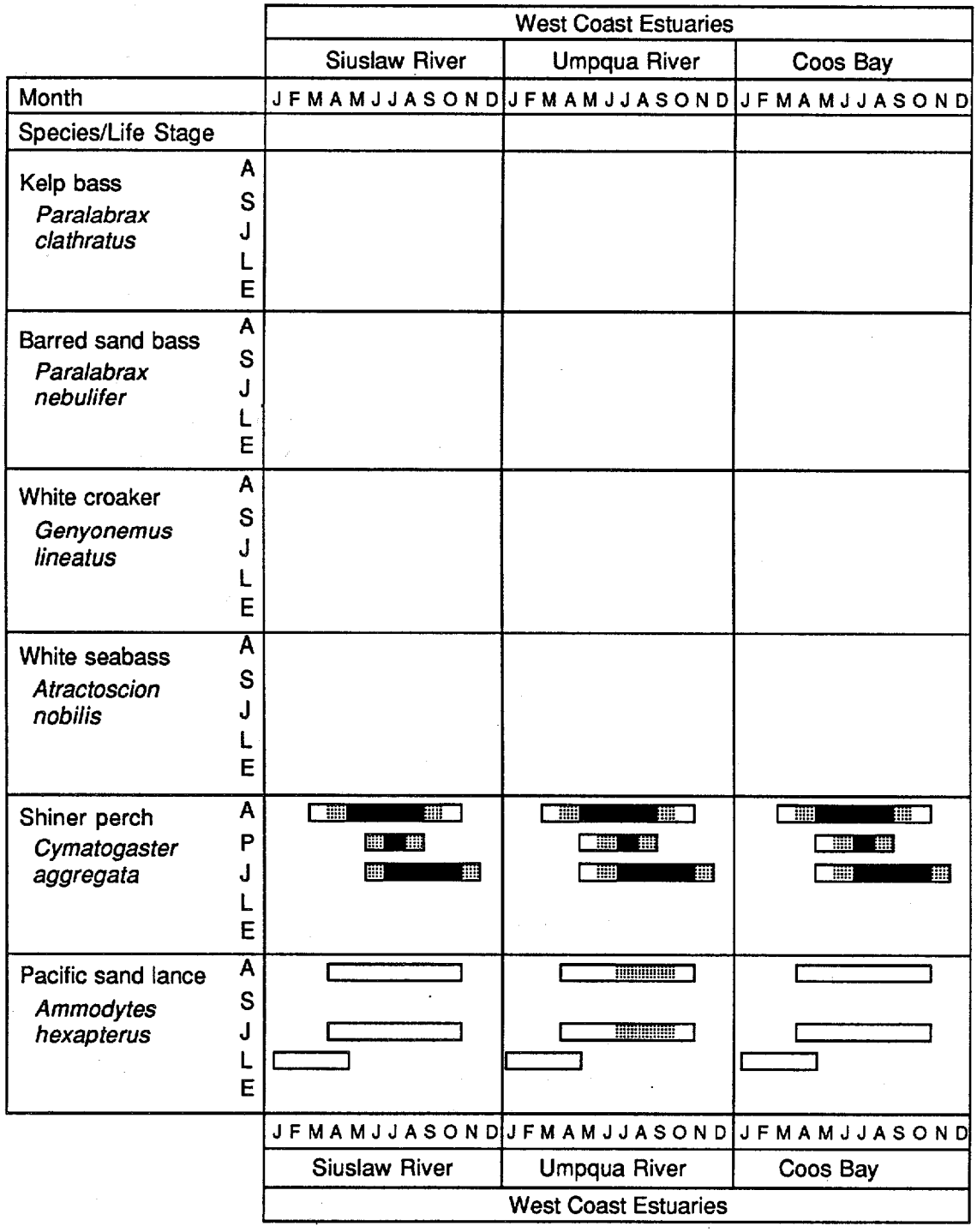
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

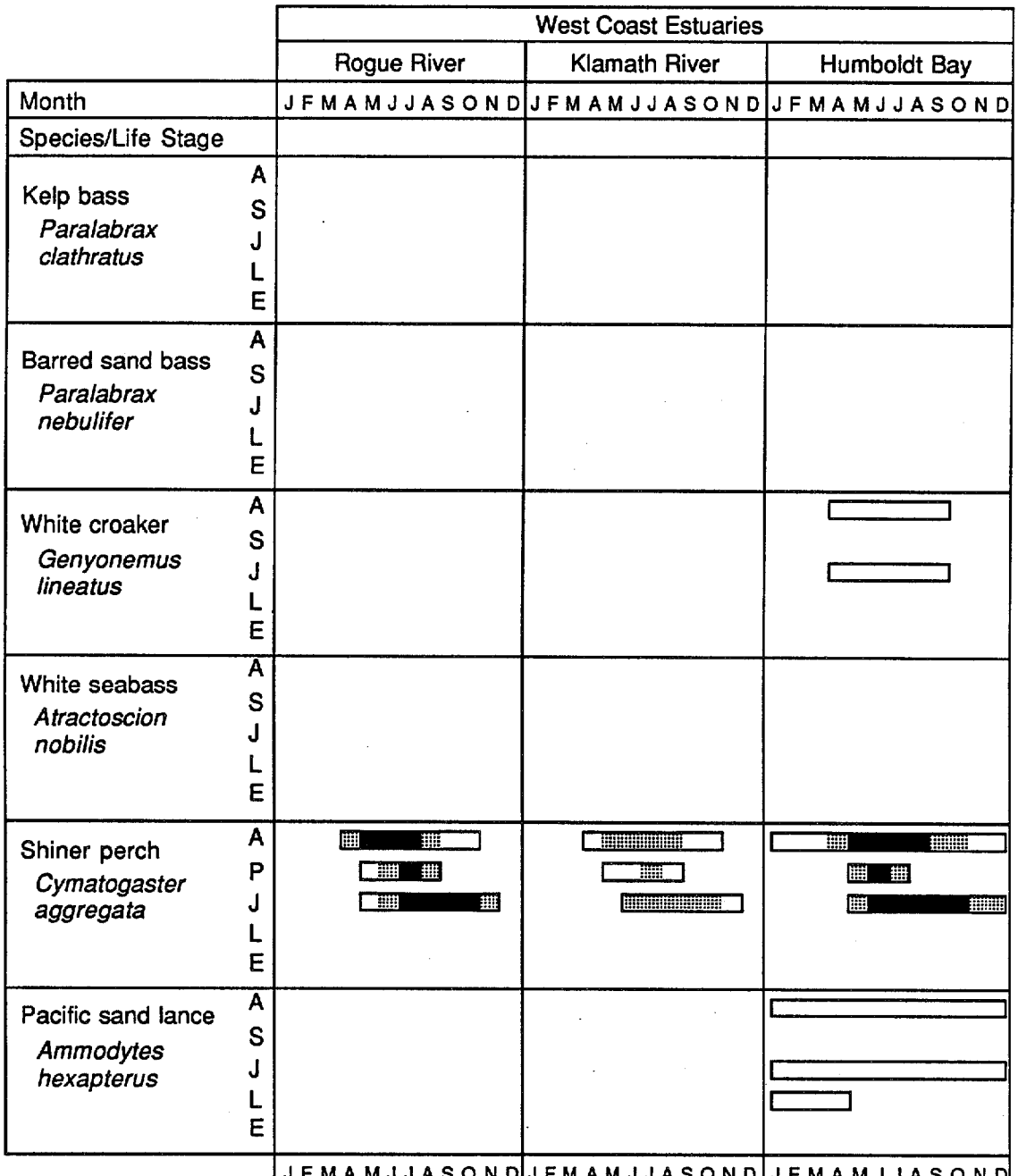
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

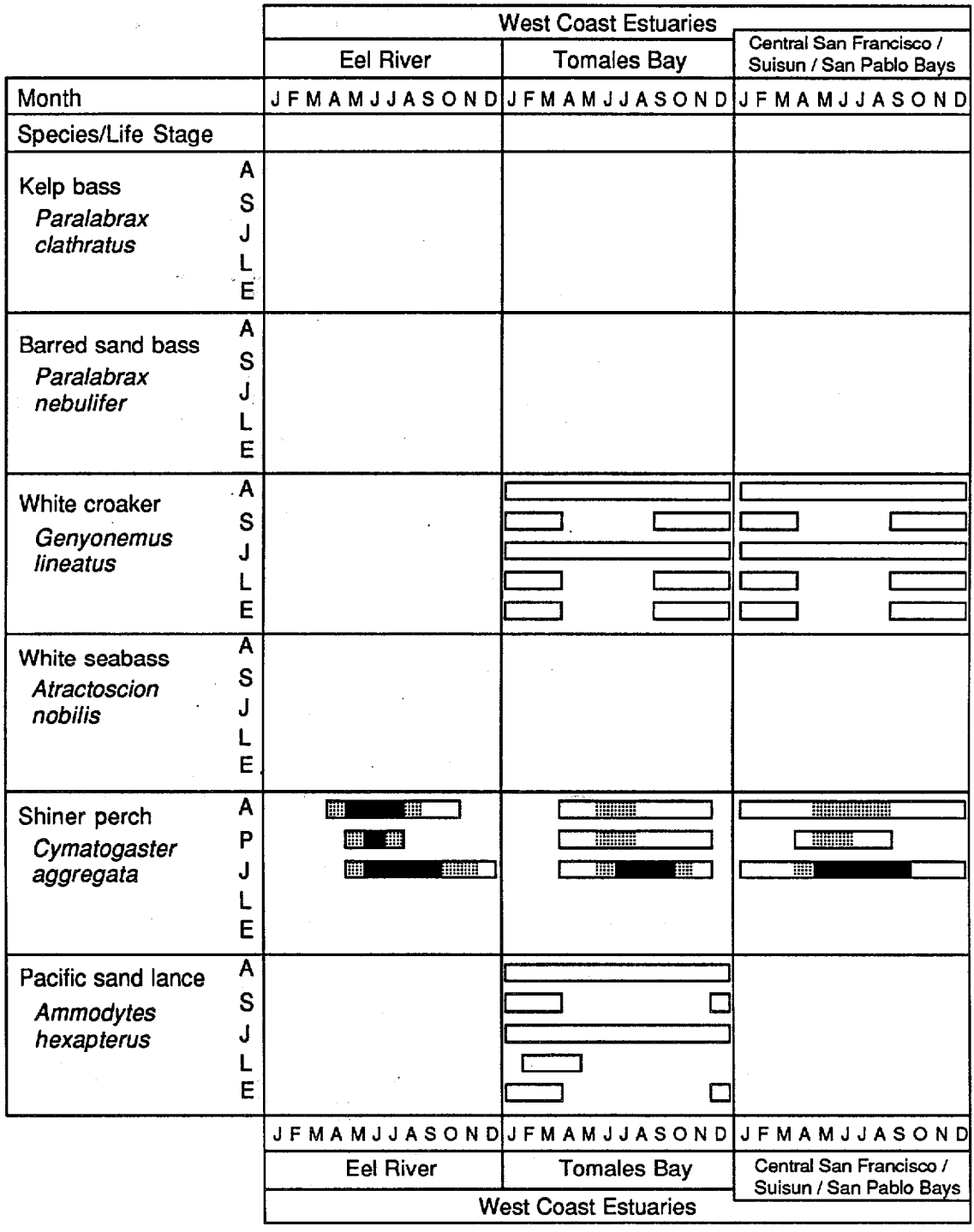
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

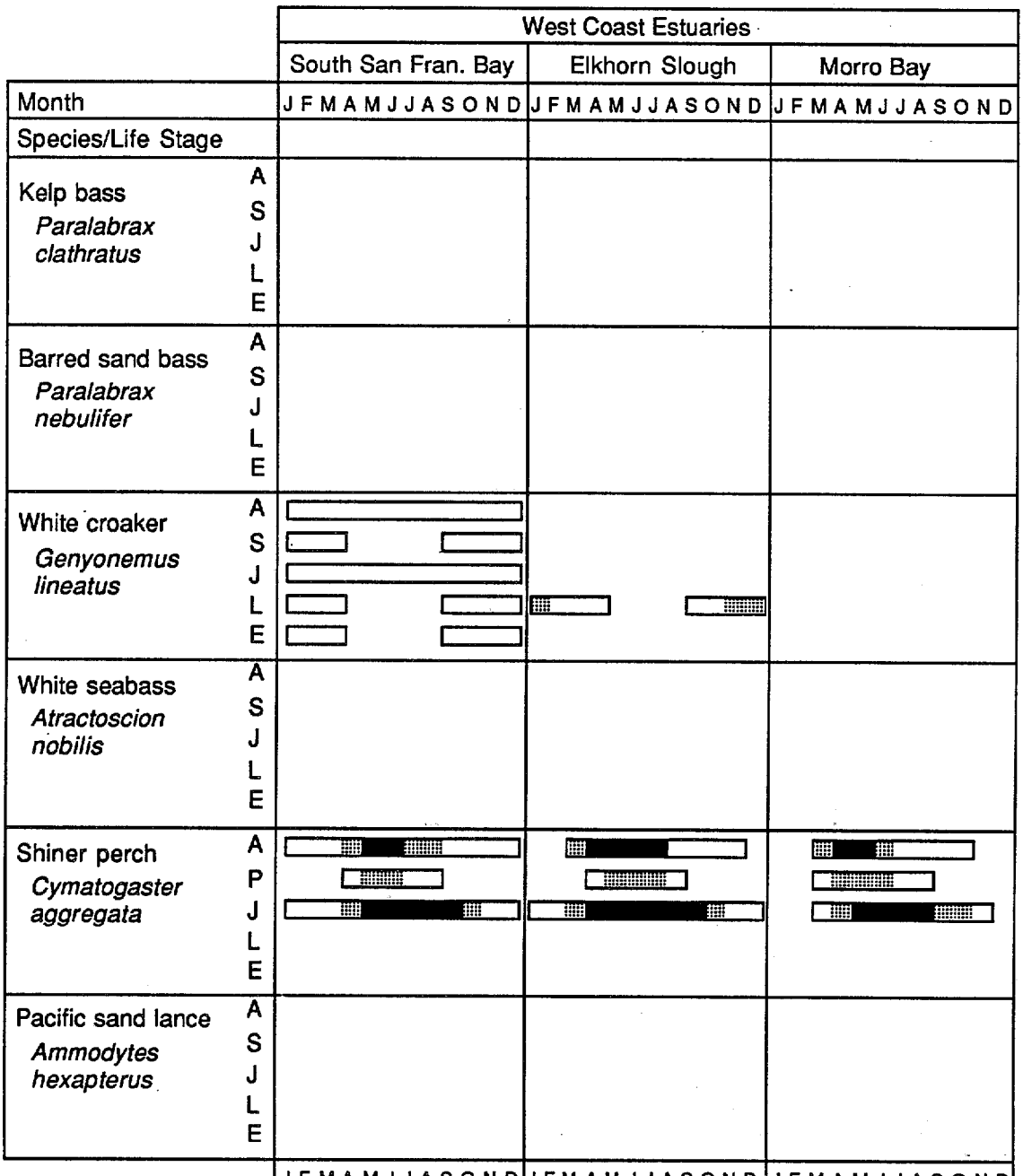
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

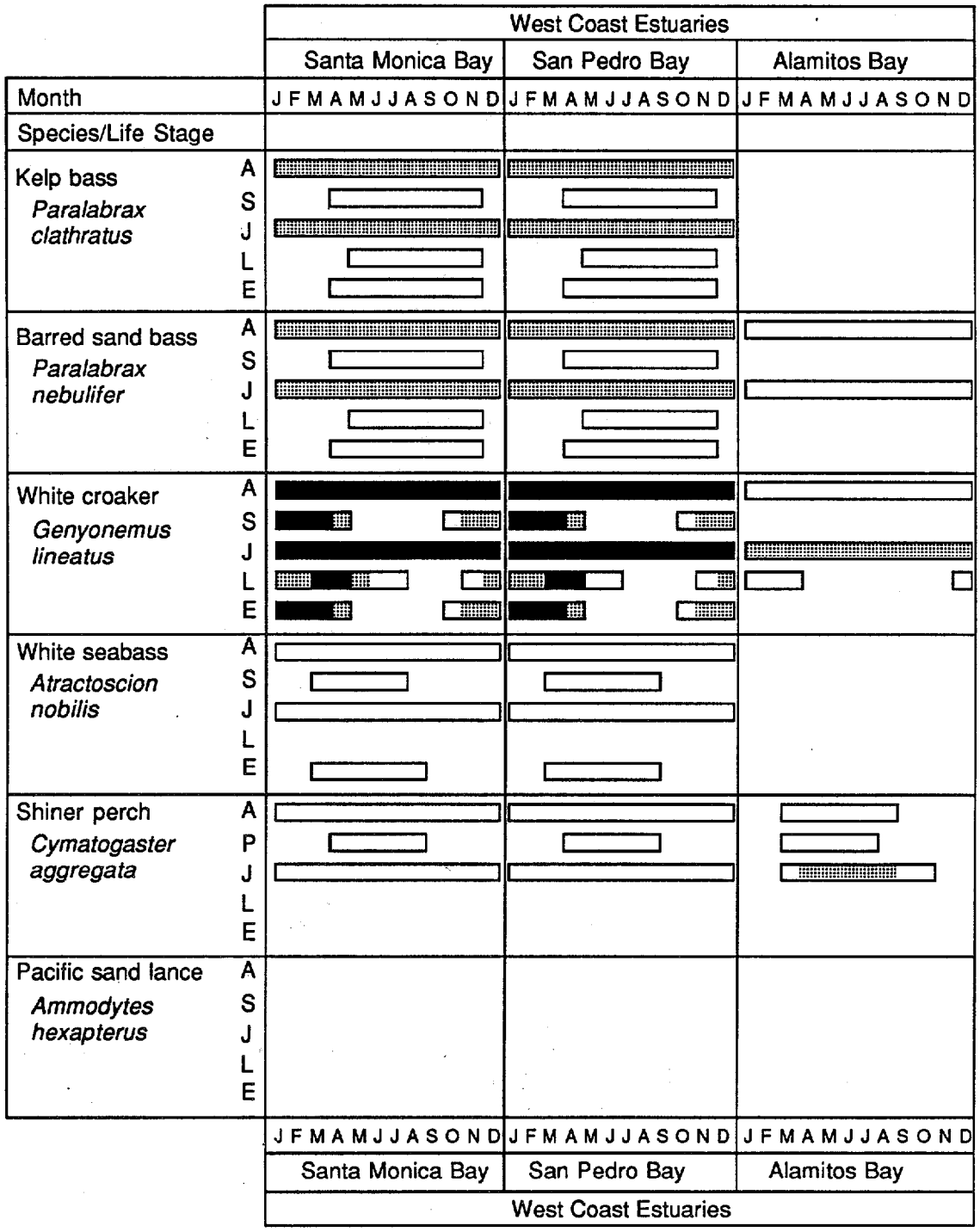
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

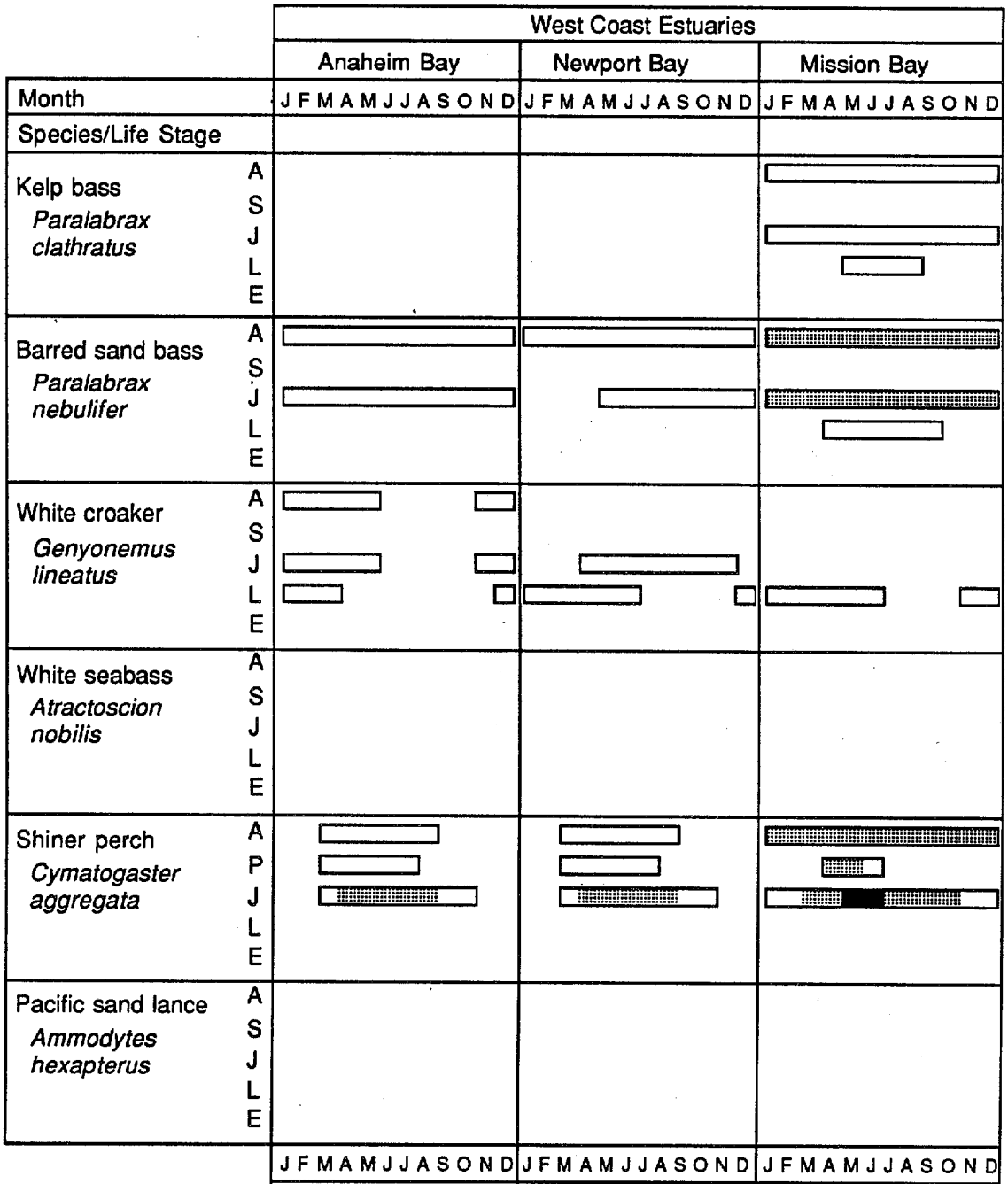
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

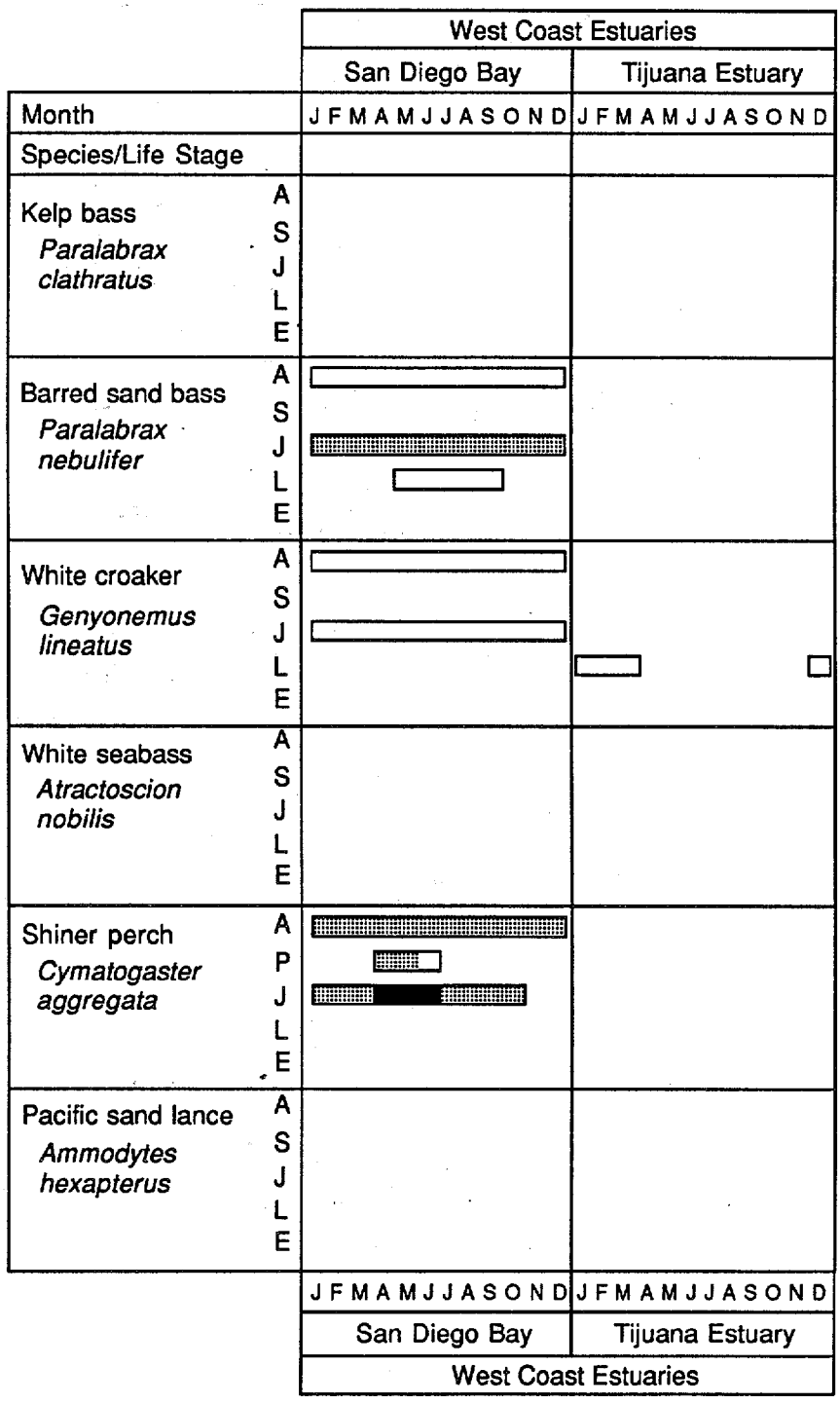
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

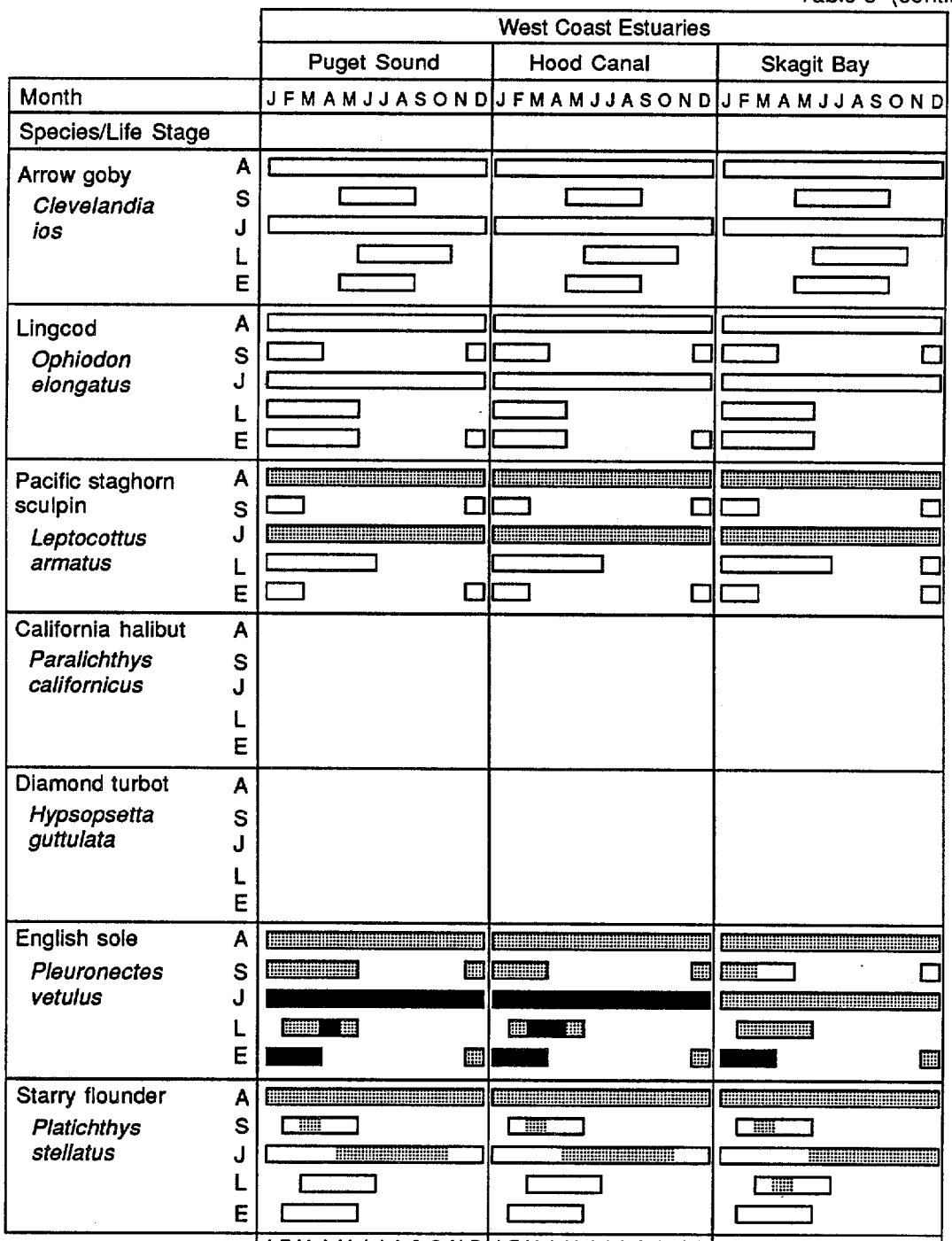
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs
- P - Parturition

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

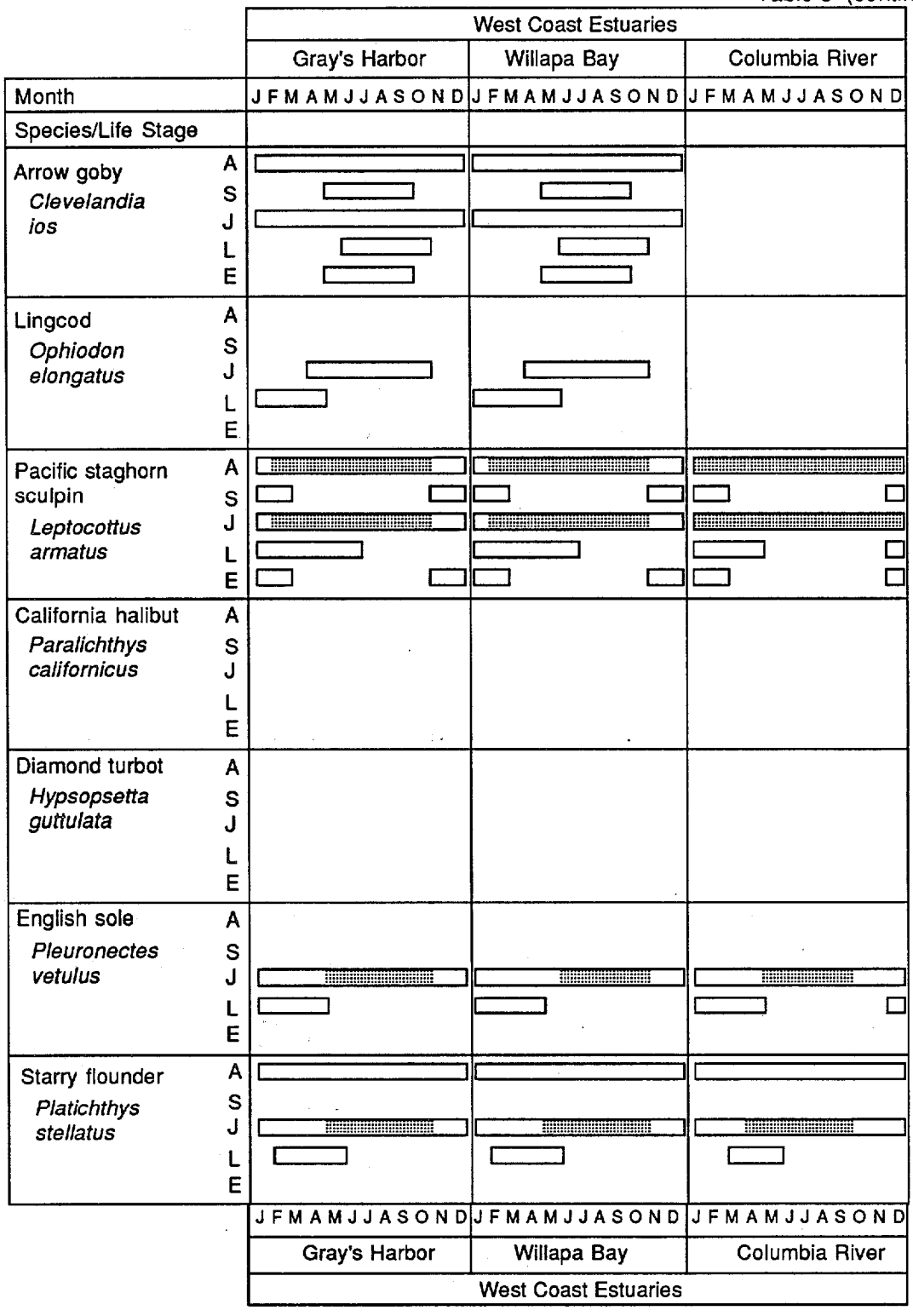
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

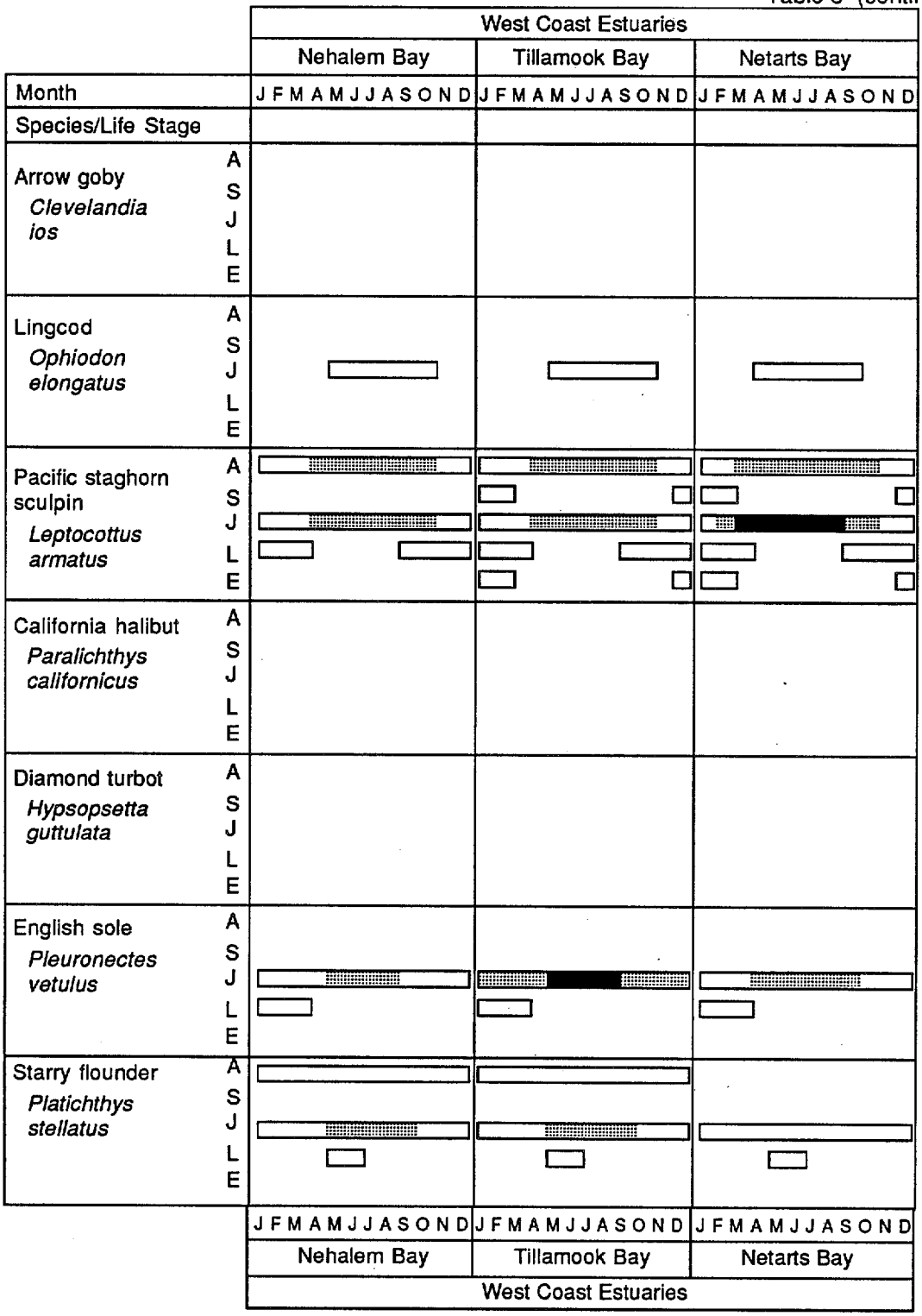
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



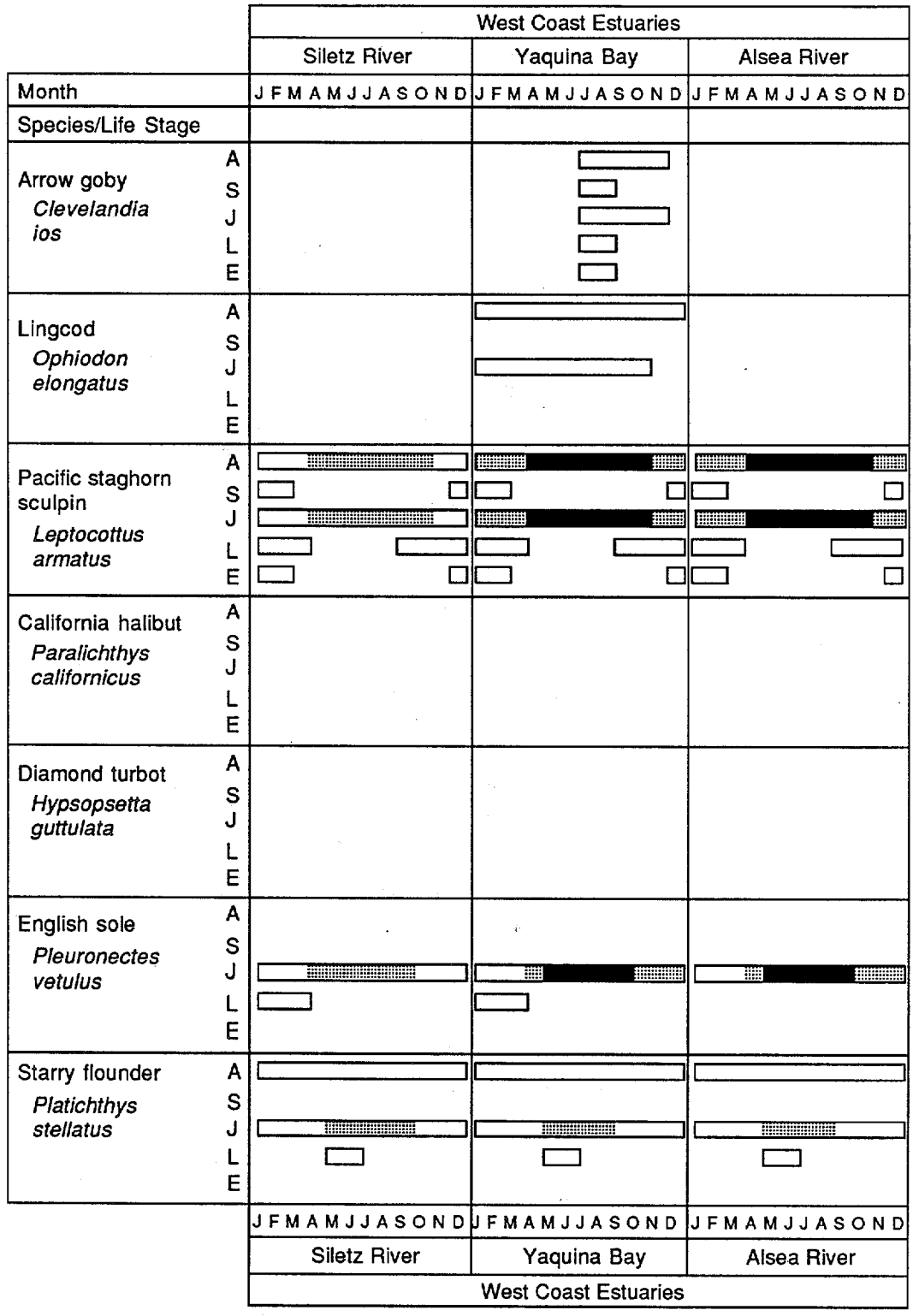
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution (revised 1/91).



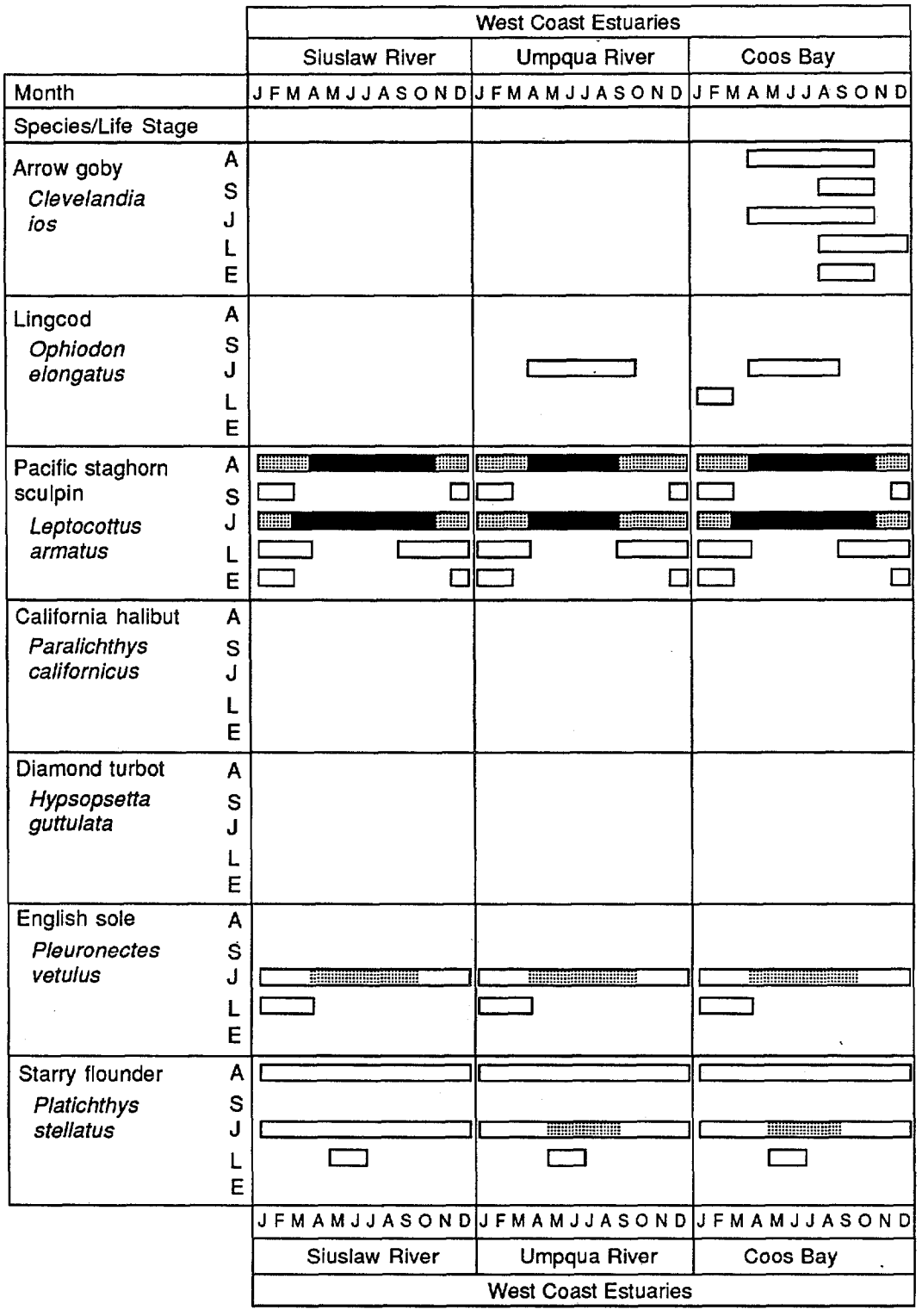
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3, continued. Temporal distribution (revised 1/91).



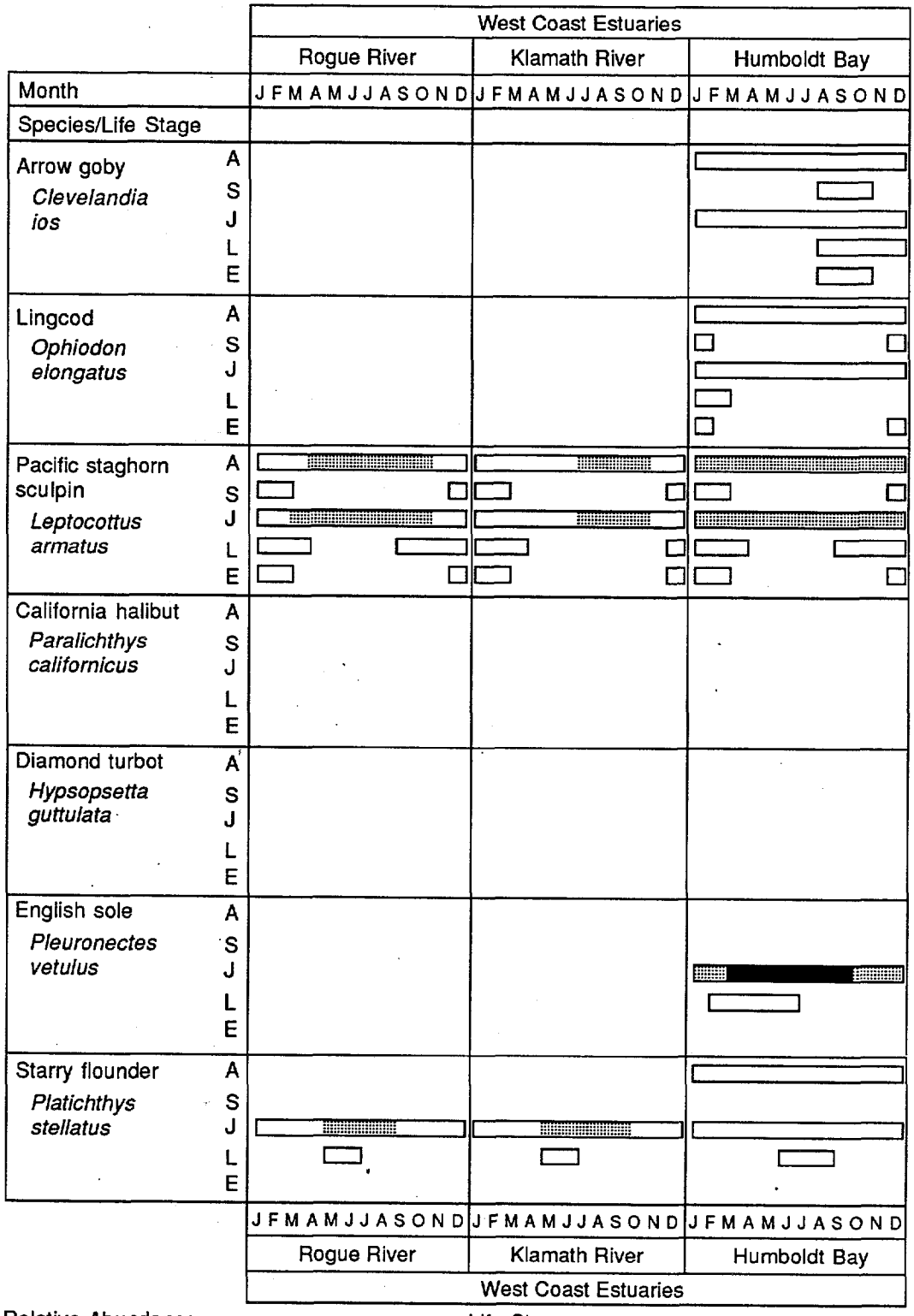
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution (revised 1/91).



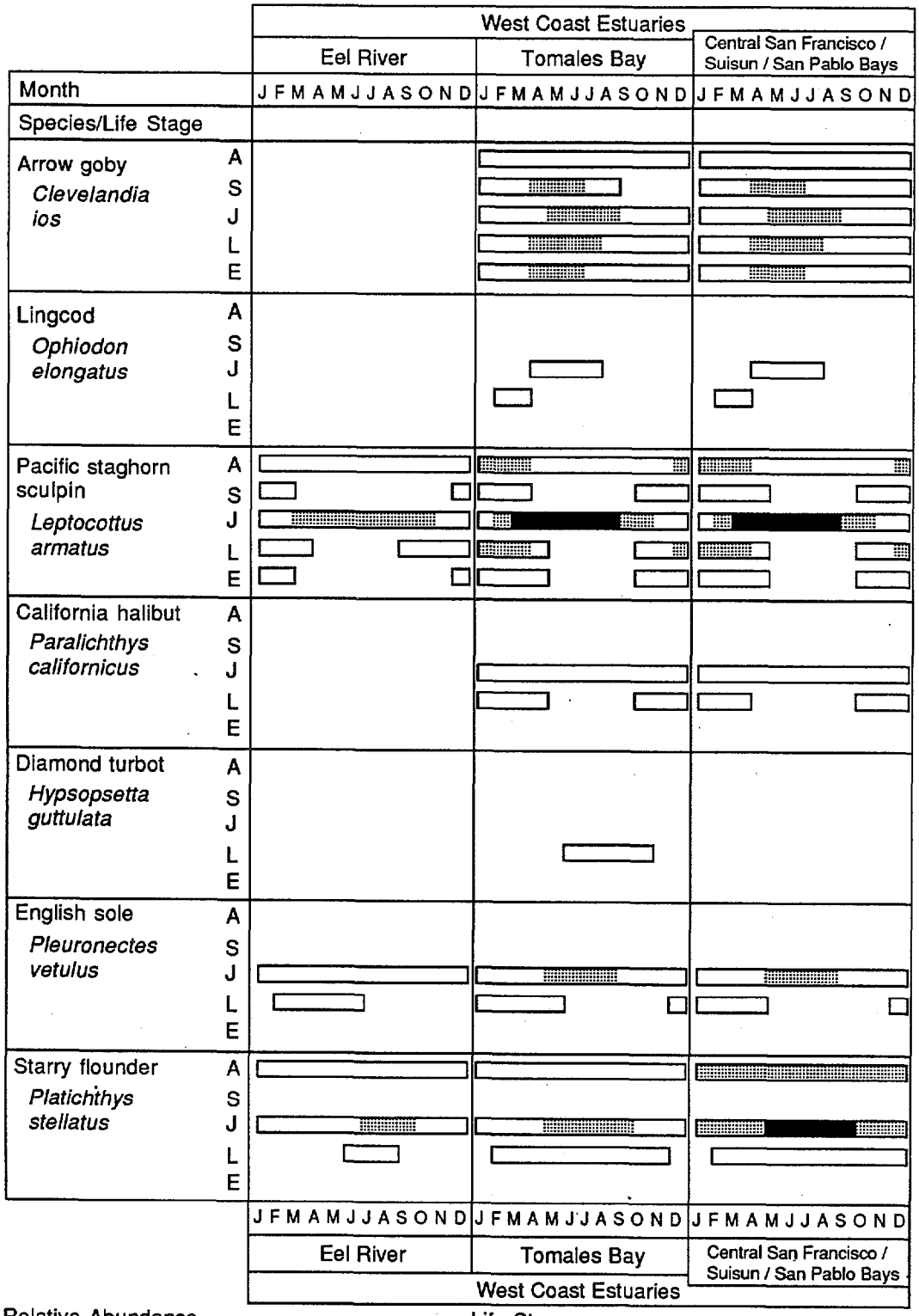
Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution (revised 1/91).



Relative Abundance

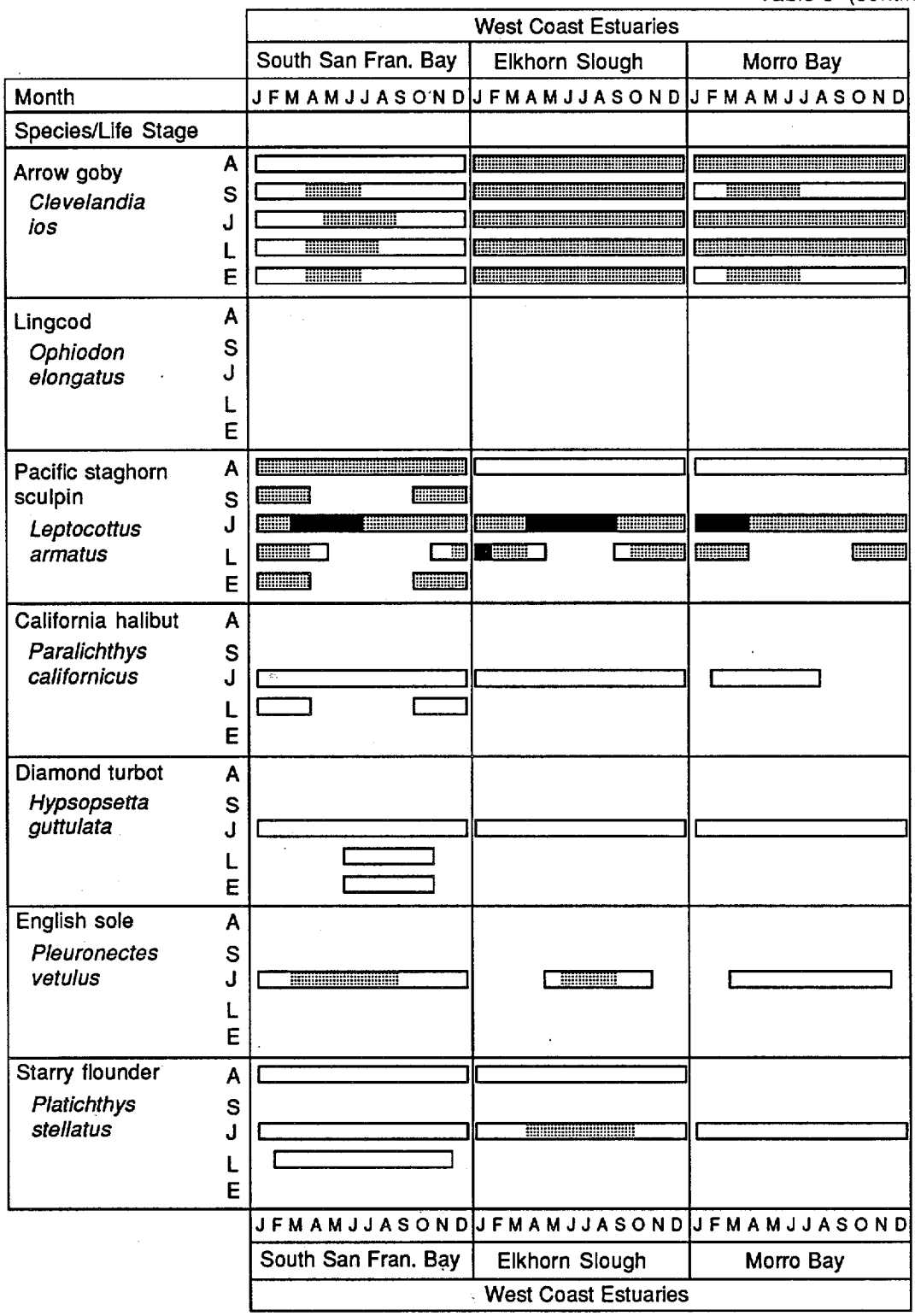
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

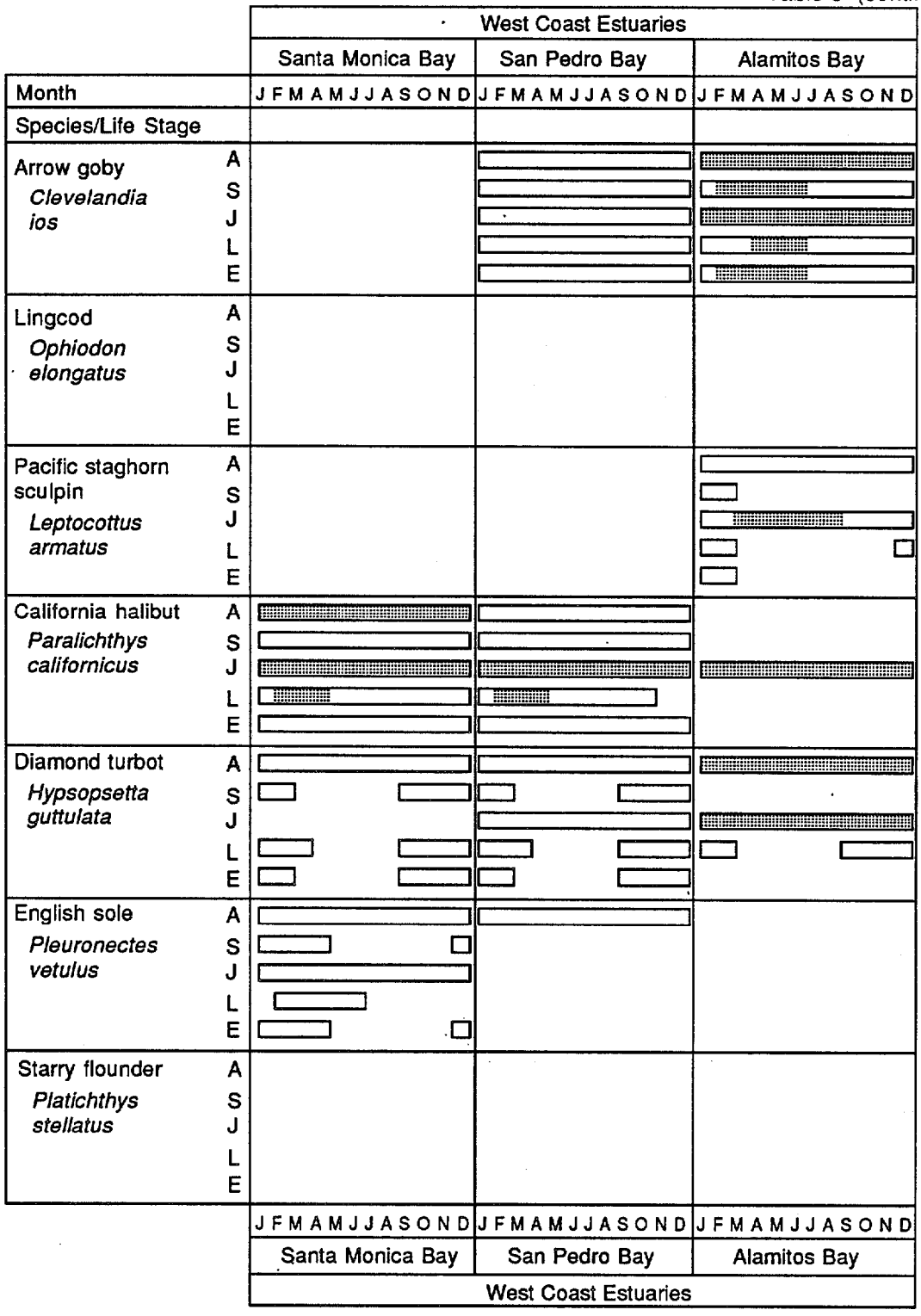
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

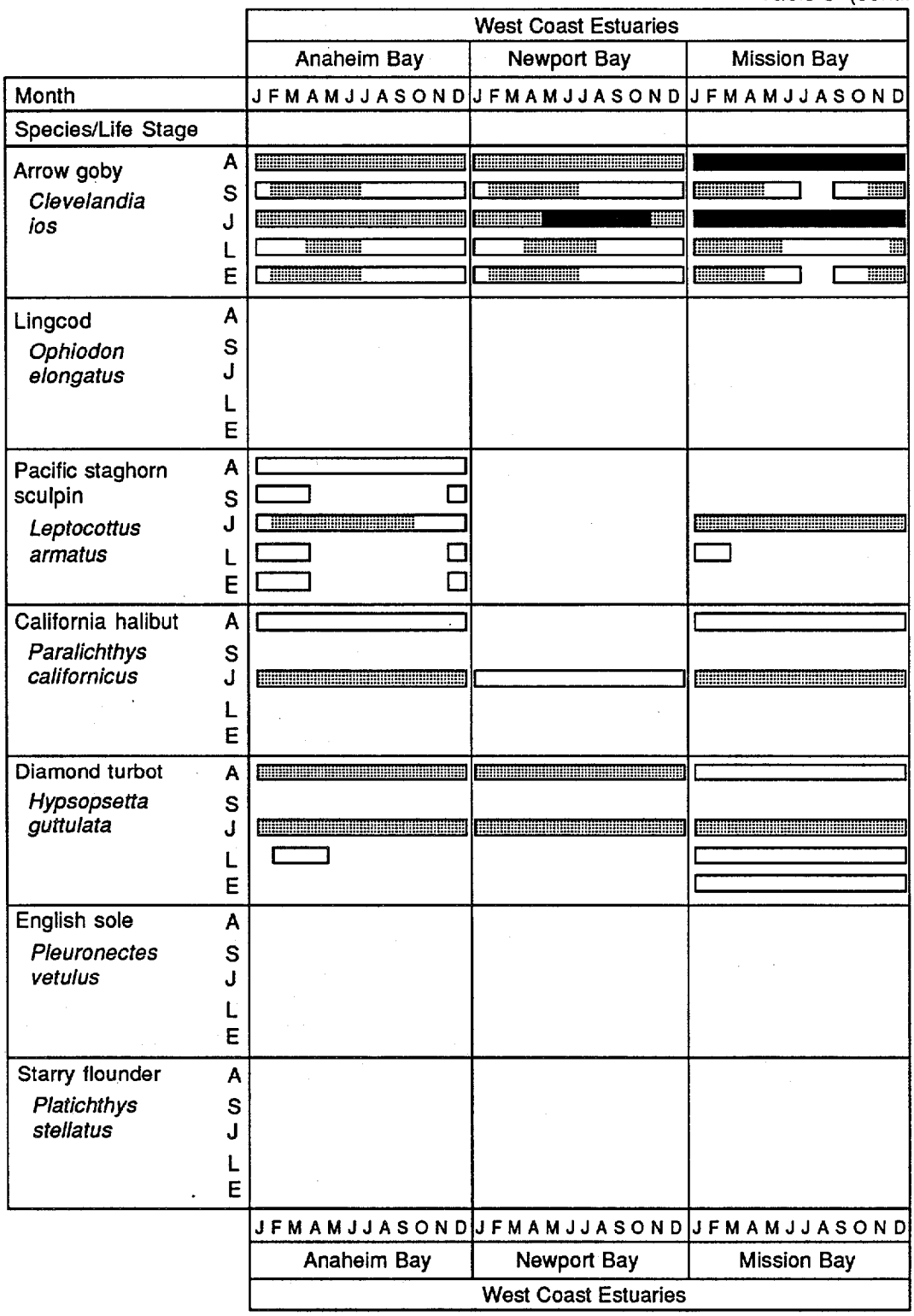
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

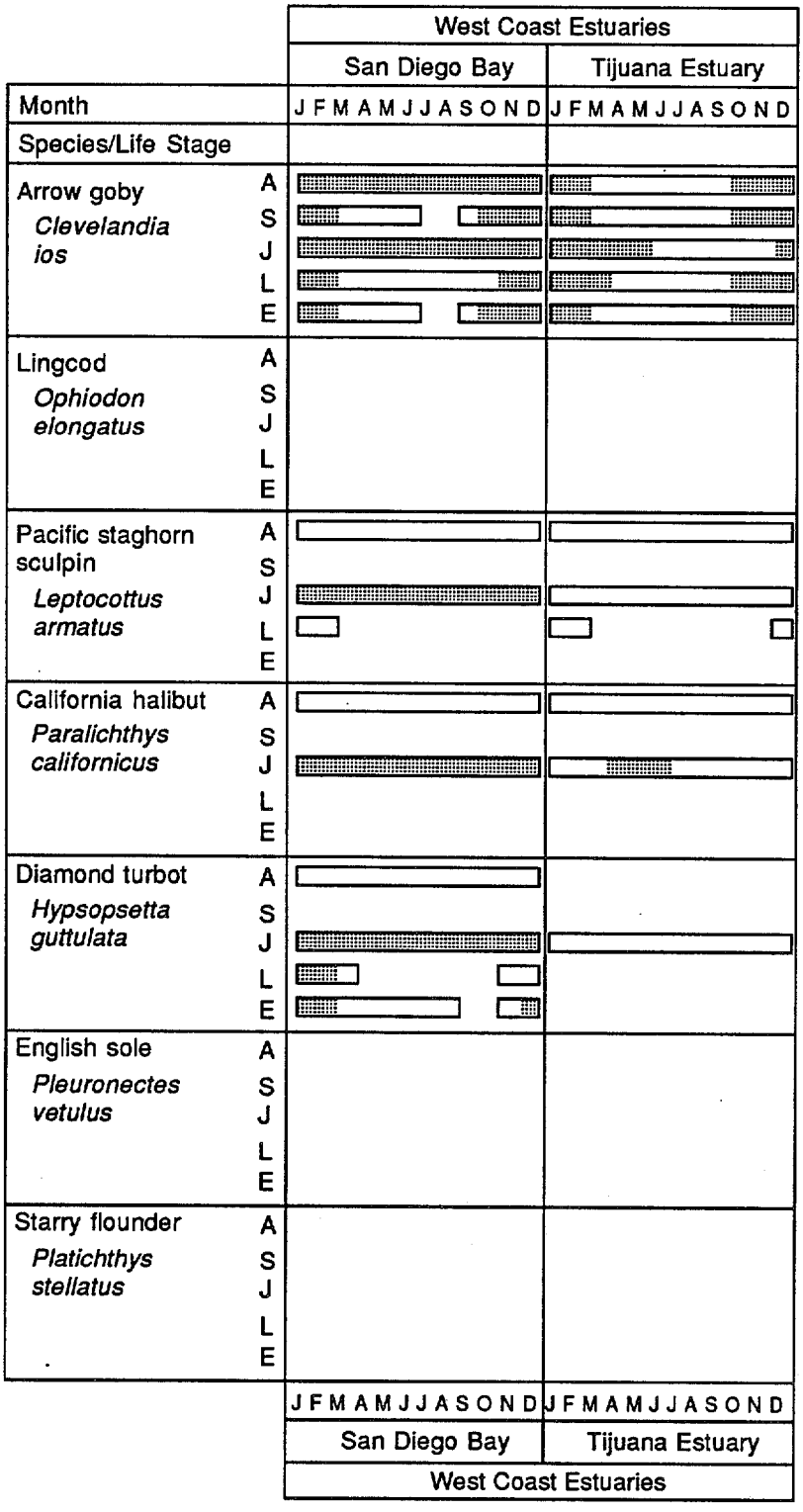
- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Temporal Distribution

Table 3 (continued).



Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank — Not present, Rare, or No Data Available

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 4. Data reliability

Index to Table 4: Page location of data reliability table for each species and estuary

Common and Scientific Name	Puget Sound, Hood Canal, Skagit Bay, Grays Harbor, Willapa Bay, Columbia River, Nehalem Bay, Tillamook Bay	Netarts Bay, Siletz River, Yaquina Bay, Alsea River, Siuslaw River, Umpqua River, Coos Bay, Rogue River	Klamath River, Humboldt Bay, Eel River, Tomales Bay, Cent. S. Fran./Suisun/ San Pablo Bays, South San Fran. Bay, Elkhorn Slough, Morro Bay	Santa Monica Bay, San Pedro Bay, Alamitos Bay, Anaheim Bay, Newport Bay, Mission Bay, San Diego Bay, Tijuana Estuary
Blue mussel (*Mytilus edulis*) Pacific oyster (*Crassostrea gigas*) Horseneck gaper (*Tresus capax*) Pacific gaper (*Tresus nuttali*) California jackknife clam (*Tagelus californianus*) Pacific littleneck clam (*Protothaca staminea*)	p. 149	p. 150	p. 151	p. 152
Manila (Japanese) clam (*Venerupis japonica*) Eastern softshell clam (*Mya arenaria*) Geoduck (*Panope abrupta*) Bay shrimp (*Crangon franciscorum*) Dungeness crab (*Cancer magister*) Leopard shark (*Triakis semifasciata*)	p. 153	p. 154	p. 155	p. 156
Green sturgeon (*Acipenser medirostris*) White sturgeon (*Acipenser transmontanus*) American shad (*Alosa sapidissima*) Pacific herring (*Clupea pallasi*) Deepbody anchovy (*Anchoa compressa*) Slough anchovy (*Anchoa delicatissima*)	p. 157	p. 158	p. 159	p. 160
Northern anchovy (*Engraulis mordax*) Cutthroat trout (*Oncorhynchus clarki*) Steelhead (*Oncorhynchus mykiss*)*	p. 161	p. 162	p. 163	p. 164
Coho salmon (*Oncorhynchus kisutch*) Chinook salmon (*Oncorhynchus tshawytscha*)*	p. 165	p. 166	p. 167	p. 168
Chum salmon (*Oncorhynchus keta*) Pink salmon (*Oncorhynchus gorbuscha*) Sockeye salmon (*Oncorhynchus nerka*) Surf smelt (*Hypomesus pretiosus*) Longfin smelt (*Spirinchus thaleichthys*)	p. 169	p. 170	p. 171	p. 172
Eulachon (*Thaleichthys pacificus*) Pacific tomcod (*Microgadus proximus*) Topsmelt (*Atherinops affinis*) Jacksmelt (*Atherinopsis californiensis*) Threespine stickleback (*Gasterosteus aculeatus*) Striped bass (*Morone saxatilis*)	p. 173	p. 174	p. 175	p. 176
Kelp bass (*Paralabrax clathratus*) Barred sand bass (*Paralabrax nebulifer*) White seabass (*Atractoscion nobilis*) White croaker (*Genyonemus lineatus*) Shiner perch (*Cymatogaster aggregata*) Pacific sand lance (*Ammodytes hexapterus*)	p. 177	p. 178	p. 179	p. 180
Arrow goby (*Clevlandia ios*) Lingcod (*Ophiodon elongatus*) Pacific staghorn sculpin (*Leptocottus armatus*) California halibut (*Paralichthys californicus*) Diamond turbot (*Hypsopsetta guttulata*) English sole (*Pleuronectes vetulus*) Starry flounder (*Platichthys stellatus*)	p. 181	p. 182	p. 183	p. 184

* Winter steelhead and summer chinook salmon are located four pages after the pages shown here.

Table 4. Data Summary Table: Data Reliability

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Grays Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Blue mussel *Mytilis edulis*	A	■	■	■	■	■	■	□	▣
	S	■	▣	▣	▣	■	□	□	□
	J	■	■	■	■	■	■	□	▣
	L	■	▣	▣	▣	■	□	□	□
	E	■	▣	▣	▣	■	□	□	□
Pacific oyster *Crassostrea gigas*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Horseneck gaper *Tresus capax*	A	■	■	■	■	■	■	■	■
	S	■	■	■	▣	□	■	□	□
	J	■	■	■	■	■	■	■	■
	L	▣	▣	■	□	□	■	□	□
	E	■	■	■	□	□	■	□	□
Pacific gaper *Tresus nuttalli*	A	■	■	■	■	■	■	■	■
	S	□	□	□	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	□	□	□	■	■	■	■	■
	E	□	□	□	■	■	■	■	■
California jacknife clam *Tagelus californianus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific littleneck clam *Protothaca staminea*	A	■	■	■	■	□	■	■	■
	S	▣	▣	▣	□	□	■	□	■
	J	■	■	■	■	□	■	■	■
	L	□	□	▣	□	□	■	□	■
	E	□	□	▣	□	□	■	□	■
		Puget Sound	Hood Canal	Skagit Bay	Grays Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 4 (continued). Data Summary Table: Data Reliability

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Blue mussel *Mytilis edulis*	A	▣	■	▣	■	▣	▣	▣	■
	S	□	□	□	□	□	□	□	□
	J	▣	■	▣	■	▣	▣	▣	■
	L	□	□	□	□	□	□	□	□
	E	□	□	□	□	□	□	□	□
Pacific oyster *Crassostrea gigas*	A	□	■	■	■	■	■	■	■
	S	□	■	□	■	■	■	□	■
	J	□	■	■	■	■	■	■	■
	L	□	■	□	■	■	■	□	■
	E	□	■	□	■	■	■	□	■
Horseneck gaper *Tresus capax*	A	■	■	■	■	■	▣	■	■
	S	□	■	■	□	□	□	▣	■
	J	■	■	■	■	■	▣	■	■
	L	□	■	■	□	□	□	▣	■
	E	□	■	■	□	□	□	▣	■
Pacific gaper *Tresus nuttalli*	A	■	■	■	■	■	■	■	■
	S	□	■	□	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	□	■	□	■	■	■	■	■
	E	□	■	□	■	■	■	■	■
California jacknife clam *Tagelus californianus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific littleneck clam *Protothaca staminea*	A	□	■	■	■	■	■	■	■
	S	□	■	■	□	□	■	□	■
	J	□	■	■	■	■	■	■	■
	L	□	■	■	□	□	■	□	■
	E	□	■	■	□	□	■	□	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Blue mussel *Mytilis edulis*	A	■	■	▣	▣	▣	▣	▣	▣
	S	■	■	□	□	□	□	□	■
	J	■	▣	□	▣	▣	▣	▣	▣
	L	■	□	▣	□	□	□	□	■
	E	■	■	□	□	□	□	□	■
Pacific oyster *Crassostrea gigas*	A	■	■	■	■	■	□	■	■
	S	■	■	■	■	□	□	□	▣
	J	■	■	■	■	■	□	■	■
	L	■	■	■	▣	□	□	□	▣
	E	■	■	■	▣	□	□	□	▣
Horseneck gaper *Tresus capax*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific gaper *Tresus nuttalli*	A	■	■	■	□	□	□	■	▣
	S	■	□	■	□	□	□	■	□
	J	■	■	■	□	□	□	■	▣
	L	■	□	■	□	□	□	■	□
	E	■	□	■	□	□	□	■	□
California jacknife clam *Tagelus californianus*	A	■	■	■	□	□	■	□	▣
	S	■	■	■	□	□	■	□	□
	J	■	■	■	□	□	■	□	▣
	L	■	■	■	□	□	■	□	□
	E	■	■	■	□	□	■	□	□
Pacific littleneck clam *Protothaca staminea*	A	■	■	■	▣	□	□	▣	■
	S	■	□	■	□	□	□	□	□
	J	■	■	■	▣	□	□	▣	■
	L	■	□	■	□	□	□	□	□
	E	■	□	■	□	□	□	□	□
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Blue mussel *Mytilis edulis*	A	☐	▣	▣	▣	▣	☐	▣	☐
	S	☐	☐	▣	☐	☐	☐	☐	☐
	J	☐	▣	▣	▣	▣	☐	▣	☐
	L	☐	☐	▣	☐	☐	☐	☐	☐
	E	☐	☐	▣	☐	☐	☐	☐	☐
Pacific oyster *Crassostrea gigas*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Horseneck gaper *Tresus capax*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific gaper *Tresus nuttalli*	A	☐	■	☐	▣	☐	▣	▣	▣
	S	☐	☐	☐	☐	☐	▣	▣	▣
	J	☐	■	☐	☐	☐	▣	▣	▣
	L	☐	☐	☐	☐	☐	▣	▣	▣
	E	☐	☐	☐	☐	☐	▣	▣	▣
California jacknife clam *Tagelus californianus*	A	▣	▣	☐	☐	▣	☐	▣	▣
	S	☐	☐	☐	☐	☐	☐	☐	☐
	J	▣	▣	☐	☐	▣	☐	▣	▣
	L	☐	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐	☐
Pacific littleneck clam *Protothaca staminea*	A	▣	▣	▣	▣	☐	☐	■	■
	S	☐	☐	☐	☐	☐	☐	■	☐
	J	▣	▣	▣	▣	☐	☐	■	■
	L	☐	☐	☐	☐	☐	☐	■	☐
	E	☐	☐	☐	☐	☐	☐	■	☐
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- ☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Manila clam *Venerupis japonica*	A	■	■	■	▣	■	■	■	▣
	S	■	■	□	□	■	■	■	□
	J	■	■	■	▣	■	■	■	▣
	L	▣	■	□	□	■	■	■	□
	E	▣	■	□	□	■	■	■	□
Eastern softshell clam *Mya arenaria*	A	■	■	■	■	■	■	■	■
	S	▣	□	■	□	▣	□	□	□
	J	■	■	■	■	■	■	■	■
	L	▣	□	■	□	▣	□	□	□
	E	▣	□	■	□	▣	□	□	□
Geoduck *Panope abrupta*	A	■	■	■	■	■	■	■	■
	S	▣	▣	□	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	□	▣	□	■	■	■	■	■
	E	▣	▣	□	■	■	■	■	■
Bay shrimp *Crangon franciscorum*	A	■	□	■	■	□	□	□	□
	S	▣	□	□	□	□	□	□	□
	J	▣	□	□	□	□	■	□	□
	L	□	□	□	□	□	□	□	□
	E	▣	□	□	□	□	□	□	□
Dungeness crab *Cancer magister*	A	■	▣	■	■	▣	■	□	■
	M	■	□	■	■	■	■	□	□
	J	■	□	■	■	■	■	□	■
	L	▣	□	▣	□	□	■	□	□
	E	▣	□	■	■	■	■	□	□
Leopard shark *Triakis semifasciata*	A	■	■	■	■	■	■	■	■
	P	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	M	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Manila clam *Venerupis japonica*	A	▣	■	■	■	■	■	▣	■
	S	□	■	■	■	■	■	□	■
	J	▣	■	■	■	■	■	▣	■
	L	□	■	■	■	■	■	□	■
	E	□	■	■	■	■	■	□	■
Eastern softshell clam *Mya arenaria*	A	■	□	■	▣	■	▣	■	■
	S	□	□	□	□	□	□	□	■
	J	■	□	■	▣	■	▣	■	■
	L	□	□	□	□	□	□	□	■
	E	□	□	□	□	□	□	□	■
Geoduck *Panope abrupta*	A	▣	■	■	■	■	■	■	■
	S	□	■	■	■	■	■	■	■
	J	▣	■	■	■	■	■	■	■
	L	□	■	■	■	■	■	■	■
	E	□	■	■	■	■	■	■	■
Bay shrimp *Crangon franciscorum*	A	□	□	■	□	▣	□	□	□
	S	□	□	■	□	□	□	□	▣
	J	□	□	■	□	▣	□	□	□
	L	□	□	□	□	□	□	□	▣
	E	□	□	▣	□	□	□	□	▣
Dungeness crab *Cancer magister*	A	□	□	■	▣	▣	▣	▣	□
	M	□	□	□	▣	▣	▣	□	■
	J	▣	□	■	▣	▣	▣	▣	□
	L	□	□	▣	□	□	□	▣	□
	E	□	□	□	▣	▣	□	□	■
Leopard shark *Triakis semifasciata*	A	■	■	■	■	■	■	□	■
	P	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	M	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Manila clam *Venerupis japonica*	A	■	■	■	□	■	■	□	■
	S	■	□	■	□	□	□	□	■
	J	■	■	■	□	▣	■	□	■
	L	■	□	■	□	□	□	□	■
	E	■	□	■	□	□	□	□	■
Eastern softshell clam *Mya arenaria*	A	■	■	□	□	■	▣	▣	□
	S	■	■	□	□	□	□	□	□
	J	■	■	□	□	■	▣	▣	□
	L	■	■	□	□	□	□	□	□
	E	■	■	□	□	□	□	□	□
Geoduck *Panope abrupta*	A	■	▣	■	■	■	■	■	■
	S	■	□	■	■	■	■	■	□
	J	■	▣	■	■	■	■	■	■
	L	■	□	■	■	■	■	■	□
	E	■	□	■	■	■	■	■	□
Bay shrimp *Crangon franciscorum*	A	□	□	□	□	■	■	■	■
	S	▣	□	□	□	■	■	■	■
	J	□	▣	□	□	■	■	■	■
	L	▣	▣	□	□	■	■	■	■
	E	▣	□	□	□	□	■	■	■
Dungeness crab *Cancer magister*	A	□	■	□	□	■	■	■	▣
	M	▣	▣	▣	□	□	■	■	▣
	J	□	■	□	▣	■	■	■	▣
	L	□	□	□	□	■	■	■	▣
	E	□	□	▣	□	■	■	■	▣
Leopard shark *Triakis semifasciata*	A	■	▣	■	□	▣	▣	■	▣
	P	■	□	■	□	■	▣	■	▣
	J	■	▣	■	□	□	▣	■	▣
	M	■	■	■	□	□	■	■	■
	E	■	■	■	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Manila clam *Venerupis japonica*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Eastern softshell clam *Mya arenaria*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Geoduck *Panope abrupta*	A	■	□	■	■	■	■	■	■
	S	■	□	■	■	■	■	■	■
	J	■	□	■	■	■	■	■	■
	L	■	□	■	■	■	■	■	■
	E	■	□	■	■	■	■	■	■
Bay shrimp *Crangon franciscorum*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Dungeness crab *Cancer magister*	A	■	■	■	■	■	■	■	■
	M	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Leopard shark *Triakis semifasciata*	A	▣	▣	■	■	■	■	■	■
	P	□	□	■	■	■	■	■	■
	J	▣	▣	■	■	■	■	■	■
	M	□	□	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition
M - Mating

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Green sturgeon *Acipenser medirostris*	A	■	■	■	▣	▣	■	□	□
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	□	□
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White sturgeon *Acipenser transmontanus*	A	■	■	■	■	▣	■	□	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	▣	□	▣	□	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
American shad *Alosa sapidissima*	A	▣	▣	□	■	□	■	□	■
	S	■	■	■	■	▣	▣	■	■
	J	■	■	□	■	□	■	□	▣
	L	■	■	■	■	▣	■	■	■
	E	■	■	■	■	▣	■	■	■
Pacific herring *Clupea pallasi*	A	■	■	■	■	□	■	□	▣
	S	■	■	■	■	□	■	□	□
	J	■	■	■	■	▣	■	□	■
	L	■	■	■	▣	□	■	□	□
	E	■	■	■	■	□	■	□	□
Deepbody anchovy *Anchoa compressa*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Slough anchovy *Anchoa delicatissima*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua RIver	Coos Bay	Rogue River
Green sturgeon *Acipenser medirostris*	A	■	▣	■	■	■	□	▣	□
	S	■	■	■	■	■	■	■	■
	J	■	□	■	■	■	□	□	□
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White sturgeon *Acipenser transmontanus*	A	■	□	▣	□	□	□	□	▣
	S	■	□	■	□	□	■	■	▣
	J	■	□	□	□	□	▣	□	▣
	L	■	□	■	□	□	■	■	▣
	E	■	□	■	□	□	■	■	▣
American shad *Alosa sapidissima*	A	■	■	▣	▣	▣	■	■	▣
	S	■	■	□	□	■	□	□	□
	J	■	■	▣	□	▣	□	▣	□
	L	■	■	□	□	■	□	□	□
	E	■	■	□	□	■	□	□	□
Pacific herring *Clupea pallasi*	A	□	□	■	▣	▣	▣	▣	□
	S	□	□	■	□	▣	▣	■	□
	J	■	□	■	□	■	■	■	□
	L	□	□	■	□	□	□	□	□
	E	□	□	■	□	▣	□	■	□
Deepbody anchovy *Anchoa compressa*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Slough anchovy *Anchoa delicatissima*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua RIver	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							
Green sturgeon *Acipenser medirostris*	A	▣	▣	□	■	▣	□	■	□
	S	■	■	■	■	■	□	■	■
	J	▣	□	□	■	■	□	■	□
	L	■	■	■	■	□	□	■	■
	E	■	■	■	■	■	□	■	■
White sturgeon *Acipenser transmontanus*	A	▣	■	□	□	■	▣	■	▣
	S	▣	■	■	□	■	■	■	▣
	J	▣	▣	□	□	■	▣	■	▣
	L	▣	■	■	□	■	■	■	▣
	E	▣	■	■	□	■	■	■	▣
American shad *Alosa sapidissima*	A	▣	■	▣	■	■	▣	■	▣
	S	□	■	□	■	■	■	■	□
	J	□	■	▣	■	■	□	■	□
	L	□	■	□	■	■	■	■	□
	E	□	■	□	■	■	■	■	□
Pacific herring *Clupea pallasi*	A	□	■	□	■	■	■	■	□
	S	■	■	□	■	■	■	■	□
	J	□	■	▣	▣	■	■	■	□
	L	■	■	□	▣	■	■	■	□
	E	■	■	□	■	■	■	■	□
Deepbody anchovy *Anchoa compressa*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Slough anchovy *Anchoa delicatissima*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Green sturgeon *Acipenser medirostris*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White sturgeon *Acipenser transmontanus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
American shad *Alosa sapidissima*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific herring *Clupea pallasi*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Deepbody anchovy *Anchoa compressa*	A	■	▣	□	▣	▣	▣	■	■
	S	■	▣	□	▣	■	▣	▣	■
	J	■	□	□	□	▣	▣	▣	■
	L	■	▣	□	▣	■	▣	▣	■
	E	■	▣	□	▣	■	□	▣	■
Slough anchovy *Anchoa delicatissima*	A	■	▣	▣	▣	▣	▣	▣	■
	S	■	■	□	■	▣	▣	■	■
	J	■	▣	□	▣	▣	▣	▣	■
	L	■	■	□	■	■	▣	▣	■
	E	■	■	□	■	■	□	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Northern anchovy *Engraulis mordax*	A	■	■	■	■	□	■	□	▣
	S	▣	▣	□	▣	■	■	□	■
	J	■	■	■	■	□	■	□	■
	L	▣	▣	▣	▣	□	■	□	□
	E	▣	▣	□	▣	□	■	□	□
Cutthroat trout *Oncorhynchus clarki*	A	■	■	▣	■	▣	■	□	▣
	S	■	■	■	■	■	■	■	▣
	J	▣	▣	▣	■	▣	■	□	▣
	L	■	■	■	■	■	■	■	▣
	E	■	■	■	■	■	■	■	▣
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	■	■	▣	▣	▣	■	□	□
	S	■	■	■	■	■	■	■	▣
	J	■	■	■	■	■	■	■	▣
	L	■	■	■	■	■	■	■	▣
	E	■	■	■	■	■	■	■	▣
Steelhead - Fall *Oncorhynchus mykiss (F)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	■	■	■	■	■	■	■	▣
	S	■	■	■	■	■	□	■	■
	J	▣	▣	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Northern anchovy *Engraulis mordax*	A	□	□	▣	□	▣	□	▣	□
	S	■	■	■	■	■	■	■	■
	J	□	□	■	□	▣	□	▣	□
	L	□	□	■	□	□	□	□	□
	E	□	■	■	■	■	■	■	■
Cutthroat trout *Oncorhynchus clarki*	A	□	▣	▣	■	▣	▣	□	▣
	S	■	■	■	■	■	■	■	■
	J	▣	□	■	■	▣	▣	▣	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	□	□	□	■	□	□	□	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Fall *Oncorhynchus mykiss (F)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	■	▣	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	□	■	■	■	▣	■	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Northern anchovy *Engraulis mordax*	A	□	▣	▣	□	■	■	▣	▣
	S	■	■	▣	▣	■	■	■	■
	J	□	■	▣	□	■	■	▣	▣
	L	□	▣	□	□	■	■	▣	□
	E	■	■	▣	▣	■	■	□	□
Cutthroat trout *Oncorhynchus clarki*	A	□	▣	□	■	■	■	■	■
	S	▣	▣	■	■	■	■	■	■
	J	□	▣	□	■	■	■	■	■
	L	▣	▣	■	■	■	■	■	■
	E	▣	▣	■	■	■	■	■	■
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	□	▣	□	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Fall *Oncorhynchus mykiss (F)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	▣	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A	■	■	▣	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	▣	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	▣	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Northern anchovy *Engraulis mordax*	A	■	■	■	■	▣	■	▣	□
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	▣	■	▣	□
	L	■	■	□	□	■	▣	▣	■
	E	■	■	□	□	■	□	▣	■
Cutthroat trout *Oncorhynchus clarki*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Cutthroat trout - Kelts *Oncorhynchus clarki (K)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	□	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Fall *Oncorhynchus mykiss (F)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Half pounder *Oncorhynchus mykiss (H)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Steelhead - Summer *Oncorhynchus mykiss (S)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	■	■	■	■	▣	■	▣	▣
	S	■	■	■	■	■	■	■	■
	J	▣	▣	■	■	□	■	□	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Coho salmon *Oncorhynchus kisutch*	A	■	■	■	■	■	■	▣	■
	S	■	■	■	■	■	■	■	■
	J	■	▣	■	■	▣	■	□	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	■	■	■	■	■	■	■	■
	S	■	□	■	■	■	■	■	■
	J	■	▣	■	■	□	■	▣	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	▣	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	▣	▣	■	■	■	■	▣	■
	S	■	■	■	■	■	■	■	■
	J	▣	□	■	■	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Coho salmon *Oncorhynchus kisutch*	A	▣	▣	■	▣	■	■	▣	■
	S	■	■	■	■	■	■	■	■
	J	■	□	■	□	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	■	▣	■	■	■	▣	▣	■
	S	■	■	■	■	■	■	■	■
	J	■	▣	■	▣	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	■	▣	▣	▣	■	▣	▣	■
	S	■	■	■	■	■	■	■	■
	J	■	▣	■	▣	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	▣	▣	▣	▣	■	■	■	□
	S	■	■	■	■	■	■	■	■
	J	▣	▣	■	▣	■	■	■	□
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Coho salmon *Oncorhynchus kisutch*	A	■	▣	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	□	▣	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	■	▣	▣	□	■	▣	■	■
	S	■	■	■	□	■	▣	■	■
	J	▣	▣	▣	□	■	▣	■	■
	L	■	■	■	□	■	▣	■	■
	E	■	■	■	□	■	▣	■	■
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	▣	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	▣	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Steelhead - Winter *Oncorhynchus mykiss (W)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Coho salmon *Oncorhynchus kisutch*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Fall *Oncorhynchus tshawytscha (F)*	A	▣	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Late Fall *Oncorhynchus tshawytscha (LF)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Winter *Oncorhynchus tshawytscha (W)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chinook salmon - Spring *Oncorhynchus tshawytscha (Sp)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability (revised 2/91).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chum salmon *Oncorhynchus keta*	A	■	■	■	■	■	■	□	□
	S	■	□	■	■	■	■	■	■
	J	■	■	□	■	▣	■	□	■
	L	■	□	■	□	■	■	■	■
	E	■	□	■	□	■	■	■	■
Pink salmon *Oncorhynchus gorbuscha*	A	■	■	■	□	■	□	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	□	■	■
	L	■	▣	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Sockeye salmon *Oncorhynchus nerka*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Surf smelt *Hypomesus pretiosus*	A	■	■	▣	■	□	■	□	■
	S	■	■	■	□	■	■	□	□
	J	■	▣	■	■	□	■	□	■
	L	■	■	■	▣	□	■	□	□
	E	■	■	■	□	□	■	□	□
Longfin smelt *Spirinchus thaleichthys*	A	□	■	□	▣	□	■	□	▣
	S	□	■	□	■	□	▣	□	■
	J	□	■	□	▣	□	■	□	■
	L	□	■	□	□	□	■	□	■
	E	□	■	□	□	□	▣	□	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chum salmon *Oncorhynchus keta*	A	■	□	▣	▣	▣	■	▣	■
	S	■	■	■	■	■	■	■	■
	J	■	□	■	□	■	■	□	■
	L	■	■	■	■	■	■	▣	■
	E	■	■	■	■	■	■	▣	■
Pink salmon *Oncorhynchus gorbuscha*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Sockeye salmon *Oncorhynchus nerka*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Surf smelt *Hypomesus pretiosus*	A	□	□	□	□	□	▣	□	□
	S	□	□	□	▣	▣	■	□	■
	J	▣	□	■	□	■	■	▣	□
	L	□	□	▣	□	□	□	□	□
	E	□	□	■	▣	□	■	□	■
Longfin smelt *Spirinchus thaleichthys*	A	■	■	□	■	■	■	□	■
	S	■	■	□	■	■	■	□	■
	J	■	■	□	■	■	■	□	■
	L	■	■	□	■	■	■	□	■
	E	■	■	□	■	■	■	□	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chum salmon *Oncorhynchus keta*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pink salmon *Oncorhynchus gorbuscha*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Sockeye salmon *Oncorhynchus nerka*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Surf smelt *Hypomesus pretiosus*	A	□	▣	□	□	■	■	■	■
	S	□	▣	▣	□	■	■	■	■
	J	□	▣	■	□	■	■	■	■
	L	□	▣	□	□	■	■	■	■
	E	□	▣	▣	□	■	■	■	■
Longfin smelt *Spirinchus thaleichthys*	A	□	▣	□	■	■	■	■	■
	S	□	□	□	■	■	■	■	■
	J	□	□	□	■	■	■	■	■
	L	□	▣	□	■	■	■	■	■
	E	□	□	□	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Chinook salmon - Summer *Oncorhynchus tshawytscha (Su)*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Chum salmon *Oncorhynchus keta*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pink salmon *Oncorhynchus gorbuscha*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Sockeye salmon *Oncorhynchus nerka*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Surf smelt *Hypomesus pretiosus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Longfin smelt *Spirinchus thaleichthys*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

- A - Adults
- S - Spawning
- J - Juveniles
- L - Larvae
- E - Eggs

Data Summary Table: Data Reliability (revised 2/91).

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Eulachon *Thaleichthys pacificus*	A	□	■	□	□	□	■	■	■
	S	■	■	■	▣	▣	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	□	□	■	■	■
	E	■	■	■	□	▣	■	■	■
Pacific tomcod *Microgadus proximus*	A	▣	▣	■	■	□	■	□	▣
	S	▣	□	□	▣	□	■	□	□
	J	▣	▣	▣	■	□	■	□	▣
	L	□	□	■	□	□	■	□	□
	E	□	□	□	▣	□	■	□	□
Topsmelt *Atherinops affinis*	A	■	■	■	■	■	■	□	▣
	S	■	■	■	■	■	■	□	▣
	J	■	■	■	■	■	■	□	▣
	L	■	■	■	■	■	■	□	▣
	E	■	■	■	■	■	■	□	▣
Jacksmelt *Atherinopsis californiensis*	A	■	■	■	■	■	■	□	■
	S	■	■	■	■	■	■	□	■
	J	■	■	■	■	■	■	□	■
	L	■	■	■	■	■	■	□	■
	E	■	■	■	■	■	■	□	■
Threespine stickleback *Gasterosteus aculeatus*	A	■	■	■	▣	□	■	□	▣
	S	□	□	▣	□	□	■	□	□
	J	■	□	□	□	□	■	□	▣
	L	□	□	□	▣	□	□	□	□
	E	□	□	□	□	□	□	□	□
Striped bass *Morone saxatilis*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua RIver	Coos Bay	Rogue River
		West Coast Estuaries							
Eulachon *Thaleichthys pacificus*	A	■	■	■	■	■	□	■	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	□	■	▣
	E	■	■	■	■	■	■	■	■
Pacific tomcod *Microgadus proximus*	A	□	□	▣	□	□	▣	□	□
	S	▣	□	▣	□	□	□	□	□
	J	□	□	▣	□	□	□	□	□
	L	□	□	▣	□	□	□	□	□
	E	▣	□	▣	□	□	□	□	□
Topsmelt *Atherinops affinis*	A	▣	■	■	□	▣	□	▣	■
	S	□	■	□	□	□	▣	■	■
	J	□	■	■	▣	▣	□	▣	■
	L	□	■	□	□	□	▣	□	■
	E	□	■	□	□	□	▣	■	■
Jacksmelt *Atherinopsis californiensis*	A	■	■	▣	■	■	■	□	■
	S	■	■	■	■	■	■	□	■
	J	■	■	▣	■	■	■	□	■
	L	■	■	■	■	■	■	□	■
	E	■	■	■	■	■	■	□	■
Threespine stickleback *Gasterosteus aculeatus*	A	■	□	▣	▣	▣	□	□	□
	S	□	□	□	□	□	□	□	□
	J	■	□	▣	▣	▣	□	□	□
	L	□	□	□	□	□	□	□	□
	E	□	□	□	□	□	□	□	□
Striped bass *Morone saxatilis*	A	■	■	■	■	▣	▣	▣	■
	S	■	■	■	■	▣	▣	■	■
	J	■	■	■	■	▣	▣	□	■
	L	■	■	■	■	▣	■	▣	■
	E	■	■	■	■	▣	■	▣	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua RIver	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							
Eulachon *Thaleichthys pacificus*	A	▣	■	■	■	■	■	■	■
	S	▣	■	■	■	■	■	■	■
	J	□	■	■	■	■	■	■	■
	L	□	■	■	■	■	■	■	■
	E	□	■	■	■	■	■	■	■
Pacific tomcod *Microgadus proximus*	A	■	▣	■	□	■	■	■	■
	S	■	■	■	□	■	■	■	■
	J	■	▣	■	□	■	■	■	■
	L	■	■	■	□	■	■	■	■
	E	■	■	■	□	■	■	■	■
Topsmelt *Atherinops affinis*	A	□	□	▣	□	■	■	■	▣
	S	■	□	□	□	▣	▣	■	□
	J	□	□	▣	□	■	■	▣	▣
	L	■	□	□	□	■	■	▣	□
	E	■	□	□	□	■	■	□	□
Jacksmelt *Atherinopsis californiensis*	A	■	▣	▣	□	■	■	■	▣
	S	■	▣	▣	□	▣	▣	▣	▣
	J	■	▣	▣	□	■	■	□	□
	L	■	▣	▣	□	■	■	▣	□
	E	■	▣	▣	□	▣	▣	▣	□
Threespine stickleback *Gasterosteus aculeatus*	A	▣	□	▣	□	□	□	■	□
	S	□	□	□	□	□	□	□	□
	J	▣	□	▣	□	□	□	▣	□
	L	□	□	□	□	□	□	□	□
	E	□	□	□	□	□	□	□	□
Striped bass *Morone saxatilis*	A	■	■	■	□	■	▣	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	□	▣	▣	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Eulachon *Thaleichthys pacificus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific tomcod *Microgadus proximus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Topsmelt *Atherinops affinis*	A	□	▣	■	▣	▣	■	■	■
	S	▣	□	□	■	■	▣	■	■
	J	▣	■	■	■	■	■	■	■
	L	▣	□	□	▣	■	□	▣	■
	E	▣	□	□	■	■	□	▣	■
Jacksmelt *Atherinopsis californiensis*	A	□	■	■	■	■	▣	▣	■
	S	□	■	■	■	■	□	▣	■
	J	□	□	■	■	■	□	▣	■
	L	□	▣	■	■	■	□	□	■
	E	□	□	■	■	■	□	□	■
Threespine stickleback *Gasterosteus aculeatus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Striped bass *Morone saxatilis*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							
Kelp bass *Paralabrax clathratus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Barred sand bass *Paralabrax nebulifer*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White croaker *Genyonemus lineatus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White seabass *Atractoscion nobilis*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Shiner perch *Cymatogaster aggregata*	A	■	■	■	■	□	■	▣	■
	P	▣	▣	■	□	□	□	□	▣
	J	□	□	▣	▣	□	■	□	▣
	L	□	□	□	■	□	□	□	■
	E	■	■	■	■	□	□	■	■
Pacific sand lance *Ammodytes hexapterus*	A	■	▣	■	▣	□	■	□	■
	S	▣	□	□	▣	□	▣	□	□
	J	■	▣	▣	■	□	■	□	■
	L	▣	□	■	▣	□	■	□	□
	E	▣	□	▣	▣	□	▣	□	□
		Puget Sound	Hood Canal	Skagit Bay	Gray's Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Kelp bass *Paralabrax clathratus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Barred sand bass *Paralabrax nebulifer*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White croaker *Genyonemus lineatus*	A	■	■	■	■	■	■	■	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White seabass *Atractoscion nobilis*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Shiner perch *Cymatogaster aggregata*	A	□	▣	■	□	■	■	▣	□
	P	□	□	□	□	□	▣	□	□
	J	□	□	□	□	■	■	▣	□
	L	■	■	■	■	■	■	■	▣
	E	■	■	■	▣	■	■	■	▣
Pacific sand lance *Ammodytes hexapterus*	A	▣	□	■	□	■	▣	▣	■
	S	□	□	▣	□	▣	□	▣	■
	J	▣	□	■	□	■	▣	▣	■
	L	□	□	■	□	□	□	□	■
	E	□	□	▣	□	▣	▣	▣	■
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Kelp bass *Paralabrax clathratus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Barred sand bass *Paralabrax nebulifer*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
White croaker *Genyonemus lineatus*	A	■	▣	■	□	■	▣	■	■
	S	■	■	■	□	▣	▣	■	■
	J	■	▣	■	□	▣	■	■	■
	L	■	■	■	□	□	▣	■	■
	E	■	■	■	□	▣	▣	□	■
White seabass *Atractoscion nobilis*	A	■	▣	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	▣	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Shiner perch *Cymatogaster aggregata*	A	□	▣	▣	□	▣	▣	■	▣
	P	□	▣	□	□	▣	▣	■	▣
	J	□	▣	▣	□	▣	▣	■	■
	L	▣	▣	▣	■	■	■	■	■
	E	▣	▣	▣	■	■	■	■	■
Pacific sand lance *Ammodytes hexapterus*	A	■	■	▣	□	■	■	■	■
	S	■	▣	▣	□	■	■	■	■
	J	■	■	▣	□	■	■	■	■
	L	■	■	▣	■	■	■	■	■
	E	■	□	▣	□	■	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Data Summary Table: Data Reliability

Table 4 (continued).

Species/Life Stage		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							
Kelp bass *Paralabrax clathratus*	A	■	■	▣	■	▣	▣	▣	■
	S	□	□	■	■	■	□	▣	■
	J	■	■	■	■	▣	▣	▣	■
	L	□	□	▣	■	▣	▣	□	■
	E	□	□	▣	▣	▣	□	□	■
Barred sand bass *Paralabrax nebulifer*	A	■	■	▣	▣	■	▣	▣	■
	S	□	□	■	■	■	□	□	■
	J	■	■	■	■	■	■	■	■
	L	□	□	□	■	■	▣	▣	■
	E	□	□	□	■	■	□	■	■
White croaker *Genyonemus lineatus*	A	■	■	■	■	■	■	▣	■
	S	■	■	▣	■	■	▣	■	■
	J	■	■	■	▣	■	▣	▣	■
	L	■	■	□	▣	■	▣	▣	■
	E	■	■	□	▣	▣	□	■	▣
White seabass *Atractoscion nobilis*	A	■	■	■	■	■	□	■	■
	S	▣	▣	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	▣
	L	□	□	■	■	■	■	■	■
	E	▣	▣	■	■	■	■	■	■
Shiner perch *Cymatogaster aggregata*	A	■	■	■	▣	■	▣	▣	■
	P	■	▣	▣	▣	▣	▣	▣	■
	J	■	■	■	▣	■	▣	▣	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific sand lance *Ammodytes hexapterus*	A	□	■	■	■	■	■	■	■
	S	□	■	■	■	■	■	■	■
	J	□	■	■	■	■	■	■	■
	L	□	■	■	■	■	■	■	■
	E	□	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs
P - Parturition

Table 4 (continued). Data Reliability

Species/Life Stage		West Coast Estuaries							
		Puget Sound	Hood Canal	Skagit Bay	Grays Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
Arrow goby *Clevelandia ios*	A	▣	▣	▣	▣	□	■	□	▣
	S	□	□	□	□	□	■	□	■
	J	▣	▣	▣	▣	□	■	□	▣
	L	□	□	□	□	□	■	□	■
	E	□	□	□	□	□	■	□	■
Lingcod *Ophiodon elongatus*	A	■	■	▣	■	■	□	■	■
	S	■	■	□	■	■	□	■	■
	J	■	□	▣	■	□	□	□	■
	L	□	□	□	□	□	□	□	■
	E	■	■	▣	■	■	□	■	■
Pacific staghorn sculpin *Leptocottus armatus*	A	■	▣	■	■	□	■	□	■
	S	□	□	▣	□	□	▣	□	□
	J	■	□	■	■	□	■	□	■
	L	□	□	■	□	□	■	□	□
	E	□	□	▣	□	□	□	□	□
California halibut *Paralichthys californicus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Diamond turbot *Hypsopsetta guttulata*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
English sole *Pleuronectes vetulus*	A	■	■	■	■	□	■	■	■
	S	▣	▣	▣	■	□	■	■	■
	J	▣	▣	■	■	□	■	□	■
	L	▣	▣	■	▣	□	■	□	□
	E	▣	▣	▣	■	□	■	■	■
Starry flounder *Platichthys stellatus*	A	■	■	■	■	□	■	□	■
	S	▣	□	■	▣	□	■	■	■
	J	▣	□	■	■	□	■	□	■
	L	▣	□	■	□	□	▣	□	□
	E	□	□	▣	□	□	■	□	▣
		Puget Sound	Hood Canal	Skagit Bay	Grays Harbor	Willapa Bay	Columbia River	Nehalem Bay	Tillamook Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 4 (continued). Data Reliability

Species/Life Stage		West Coast Estuaries							
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
Arrow goby *Clevelandia ios*	A	□	□	□	■	▣	▣	□	■
	S	□	□	□	■	▣	▣	□	■
	J	□	□	▣	■	▣	▣	□	■
	L	□	□	□	■	▣	▣	□	■
	E	□	□	□	■	▣	▣	□	■
Lingcod *Ophiodon elongatus*	A	■	■	■	■	■	■	□	■
	S	■	■	■	■	■	■	■	■
	J	▣	▣	■	□	▣	▣	▣	▣
	L	□	■	■	■	■	□	□	■
	E	■	■	■	■	■	■	■	■
Pacific staghorn sculpin *Leptocottus armatus*	A	▣	□	■	□	■	■	▣	□
	S	□	□	□	□	□	□	□	□
	J	□	□	▣	□	▣	▣	□	□
	L	□	□	■	□	□	□	□	□
	E	□	□	□	□	□	□	□	□
California halibut *Paralichthys californicus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Diamond turbot *Hypsopsetta guttulata*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
English sole *Pleuronectes vetulus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	▣	□	■	□	▣	▣	▣	□
	L	□	□	□	□	□	□	□	□
	E	■	■	■	■	■	■	■	■
Starry flounder *Platichthys stellatus*	A	■	□	■	□	▣	▣	▣	▣
	S	■	■	□	□	□	□	□	□
	J	▣	□	■	□	■	■	▣	□
	L	□	□	■	□	□	□	□	□
	E	□	□	■	□	□	□	□	□
		Netarts Bay	Siletz River	Yaquina Bay	Alsea River	Siuslaw River	Umpqua River	Coos Bay	Rogue River
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 4 (continued). Data Reliability

Species/Life Stage		West Coast Estuaries							
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
Arrow goby	A	■	▣	▣	□	▣	▣	▣	□
Clevelandia	S	■	□	▣	□	■	■	▣	□
ios	J	■	▣	▣	□	■	■	▣	□
	L	■	■	▣	□	■	■	■	□
	E	■	□	▣	□	▣	▣	▣	□
Lingcod	A	■	■	■	□	■	■	■	■
Ophiodon	S	■	□	■	□	▣	■	■	■
elongatus	J	▣	▣	▣	■	■	■	▣	■
	L	■	■	■	□	■	■	■	■
	E	■	□	■	□	■	■	■	■
Pacific staghorn	A	□	▣	▣	□	■	■	■	■
sculpin	S	□	□	□	▣	■	■	□	□
Leptocottus	J	□	▣	▣	□	▣	■	■	■
armatus	L	□	▣	□	▣	▣	▣	■	□
	E	□	□	□	▣	□	□	□	□
California halibut	A	■	■	■	▣	▣	▣	■	■
Paralichthys	S	■	■	■	▣	■	■	■	■
californicus	J	■	■	■	□	■	▣	■	▣
	L	■	■	■	□	■	■	■	■
	E	■	■	■	▣	■	■	■	■
Diamond turbot	A	■	■	■	□	■	■	▣	▣
Hypsopsetta	S	■	■	■	■	■	■	■	■
guttulata	J	■	■	■	□	■	■	■	■
	L	■	■	■	□	■	▣	□	□
	E	■	■	■	□	■	▣	□	□
English sole	A	■	■	■	■	■	■	■	■
Pleuronectes	S	■	■	■	■	■	■	■	■
vetulus	J	□	■	▣	□	■	■	■	■
	L	□	■	□	□	■	■	■	□
	E	■	■	■	□	■	■	■	□
Starry flounder	A	□	■	□	□	□	■	■	■
Platichthys	S	□	□	□	■	□	■	■	■
stellatus	J	□	■	▣	□	■	■	■	▣
	L	□	■	□	□	□	■	■	■
	E	□	□	□	■	□	■	■	■
		Klamath River	Humboldt Bay	Eel River	Tomales Bay	Cent. S. Fr. / Suisun / S. Pablo Bays	South San Fran. Bay	Elkhorn Slough	Morro Bay
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 4 (continued). Data Reliability

Species/Life Stage		West Coast Estuaries							
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
Arrow goby *Clevelandia ios*	A	■	□	□	▣	■	■	▣	□
	S	■	□	□	■	▣	■	▣	□
	J	■	□	□	■	■	■	▣	▣
	L	□	□	□	■	▣	■	■	▣
	E	■	□	□	□	□	■	▣	□
Lingcod *Ophiodon elongatus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pacific staghorn sculpin *Leptocottus armatus*	A	■	■	■	▣	■	▣	▣	■
	S	■	■	□	▣	■	□	□	□
	J	■	■	■	■	■	▣	▣	■
	L	■	■	□	■	■	▣	■	■
	E	■	■	□	▣	■	□	□	□
California halibut *Paralichthys californicus*	A	■	■	■	■	▣	▣	▣	■
	S	▣	▣	■	■	■	■	■	■
	J	■	■	▣	■	▣	■	■	■
	L	■	■	□	▣	■	▣	■	■
	E	□	□	□	▣	■	▣	■	■
Diamond turbot *Hypsopsetta guttulata*	A	■	■	▣	■	▣	▣	■	▣
	S	■	▣	■	■	▣	■	■	■
	J	▣	■	▣	■	■	■	■	■
	L	□	▣	□	▣	■	▣	■	▣
	E	□	□	□	□	■	▣	■	□
English sole *Pleuronectes vetulus*	A	■	■	■	■	■	■	■	■
	S	■	□	■	■	■	■	■	■
	J	■	▣	■	■	■	■	■	■
	L	▣	▣	▪	■	■	■	■	■
	E	▣	▣	■	■	■	■	■	■
Starry flounder *Platichthys stellatus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary
		West Coast Estuaries							

Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning
J - Juveniles
L - Larvae
E - Eggs

Table 5. Presence/absence of 47 species in West Coast estuaries

Index to Table 5: Page location of presence/absence table for each species and estuary

Common and Scientific Name	Estuary: Puget Sound, Hood Canal, Skagit Bay, Grays Harbor, Willapa Bay, Columbia River, Nehalem Bay, Tillamook Bay, Netarts Bay, Siletz River, Yaquina Bay, Alsea River, Siuslaw River, Umpqua River, Coos Bay, Rogue River, Klamath River, Humboldt Bay, Eel River, Tomales Bay, Cent. S. Fran./Suisun/San Pablo Bays, South San Fran. Bay, Elkhorn Slough, Morro Bay, Santa Monica Bay, San Pedro Bay, Alamitos Bay, Anaheim Bay, Newport Bay, Mission Bay, San Diego Bay, Tijuana Estuary
Blue mussel (*Mytilus edulis*) Pacific oyster (*Crassostrea gigas*) Horseneck gaper (*Tresus capax*) Pacific gaper (*Tresus nuttali*) California jacknife clam (*Tagelus californianus*) Pacific littleneck clam (*Protothaca staminea*) Manila (Japanese) clam (*Venerupis japonica*) Eastern softshell clam (*Mya arenaria*) Geoduck (*Panope abrupta*) Bay shrimp (*Crangon franciscorum*) Dungeness crab (*Cancer magister*) Leopard shark (*Triakis semifasciata*) Green sturgeon (*Acipenser medirostris*) White sturgeon (*Acipenser transmontanus*) American shad (*Alosa sapidissima*) Pacific herring (*Clupea pallasi*) Deepbody anchovy (*Anchoa compressa*) Slough anchovy (*Anchoa delicatissima*) Northern anchovy (*Engraulis mordax*)	p. 186	p. 187	p. 188	p. 189
Cutthroat trout (*Oncorhynchus clarki*) Steelhead (*Oncorhynchus mykiss*) Coho salmon (*Oncorhynchus kisutch*) Chinook salmon (*Oncorhynchus tshawytscha*) Chum salmon (*Oncorhynchus keta*) Pink salmon (*Oncorhynchus gorbuscha*) Sockeye salmon (*Oncorhynchus nerka*) Surf smelt (*Hypomesus pretiosus*) Longfin smelt (*Spirinchus thaleichthys*) Eulachon (*Thaleichthys pacificus*) Pacific tomcod (*Microgadus proximus*) Topsmelt (*Atherinops affinis*)	p. 190	p. 191	p. 192	p. 193
Jacksmelt (*Atherinopsis californiensis*) Threespine stickleback (*Gasterosteus aculeatus*) Striped bass (*Morone saxatilis*) Kelp bass (*Paralabrax clathratus*) Barred sand bass (*Paralabrax nebulifer*) White seabass (*Atractoscion nobilis*) White croaker (*Genyonemus lineatus*) Shiner perch (*Cymatogaster aggregata*) Pacific sand lance (*Ammodytes hexapterus*) Arrow goby (*Clevlandia ios*) Lingcod (*Ophiodon elongatus*) Pacific staghorn sculpin (*Leptocottus armatus*) California halibut (*Paralichthys californicus*) Diamond turbot (*Hypsopsetta guttulata*) English sole (*Pleuronectes vetulus*) Starry flounder (*Platichthys stellatus*)	p. 194	p. 195	p. 196	p. 197

Table 5. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species/life stage		Puget Sound T	Puget Sound M	Puget Sound S	Hood Canal T	Hood Canal M	Hood Canal S	Skagit Bay T	Skagit Bay M	Skagit Bay S	Grays Harbor T	Grays Harbor M	Grays Harbor S	Willapa Bay T	Willapa Bay M	Willapa Bay S	Columbia River T	Columbia River M	Columbia River S	Nehalem Bay T	Nehalem Bay M	Nehalem Bay S	Tillamook Bay T	Tillamook Bay M	Tillamook Bay S
Blue mussel	A		√	√		√	√		√	√		√	√		√	√			√			√	√	
Mytilus	J		√	√		√	√		√	√		√	√		√	√			√			√	√	
edulis	L		√	√		√	√		√	√		√	√		√	√			√			√	√	
Pacific oyster	A		√	√		√	√			√		√	√		√	√							√	
Crassostrea	J		√	√		√	√			√		√	√		√	√							√	
gigas	L																							
Horseneck gaper	A		√	√		√	√		√	√			√			√						√	√	
Tresus	J		√	√		√	√		√	√			√			√						√	√	
capax	L		√	√		√	√		√	√			√			√						√	√	
Pacific gaper	A		√	√		√	√		√	√			√											
Tresus	J		√	√		√	√		√	√			√											
nuttallii	L		√	√		√	√		√	√														
California jackknife clam	A																							
Tagelus	J																							
californianus	L																							
Pacific littleneck clam	A		√	√		√	√		√	√		√	√		√	√						√	√	
Protothaca	J		√	√		√	√		√	√		√	√		√	√						√	√	
staminea	L		√	√		√	√		√	√		√	√		√	√						√	√	
Manila clam	A		√	√		√	√		√	√		√	√		√	√						√		
Venerupis	J		√	√		√	√		√	√		√	√		√	√						√		
japonica	L		√	√		√	√		√	√		√	√		√	√						√		
Softshell	A		√	√		√	√		√	√		√	√		√	√		√		√		√	√	
Mya	J		√	√		√	√		√	√		√	√		√	√		√		√		√	√	
arenaria	L		√	√		√	√		√	√		√	√		√	√		√		√		√	√	
Geoduck	A		√	√		√	√			√														
Panopea	J		√	√		√	√			√														
abrupta	L		√	√		√	√			√														
Bay shrimp	A		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
Crangon	J		√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
franciscorum	L		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
Dungeness crab	A		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
Cancer	J		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
magister	L		√	√		√	√		√	√		√	√		√	√		√	√	√			√	
Leopard shark	A																							
Triakis	J																							
semifasciata	P																							
Green sturgeon	A			√								√	√		√	√		√	√					
Acipenser	J																						√	√
medirostris	L																							
White sturgeon	A			√			√				√	√	√	√	√	√	√	√	√	√	√	√		√
Acipenser	J										√	√	√	√	√	√	√	√	√	√	√	√		√
transmontanus	L																							
American shad	A			√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		
Alosa	J							√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√
sapidissima	L																							
Pacific herring	A		√	√		√	√		√	√						√			√	√		√	√	
Clupea	J		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
pallasi	L		√	√		√	√		√	√		√	√		√	√		√	√	√		√	√	
Deepbody anchovy	A																							
Anchoa	J																							
compressa	L																							
Slough anchovy	A																							
Anchoa	J																							
delicatissima	L																							
Northern anchovy	A		√	√			√		√	√		√	√		√	√		√	√		√	√	√	
Engraulis	J		√	√			√		√	√		√	√		√	√		√	√		√	√	√	
mordax	L		√	√			√		√	√		√	√		√	√		√	√		√	√	√	
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Grays Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		

Salinity Zone

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Netarts Bay T	Netarts Bay M	Netarts Bay S	Siletz River T	Siletz River M	Siletz River S	Yaquina Bay T	Yaquina Bay M	Yaquina Bay S	Alsea River T	Alsea River M	Alsea River S	Siuslaw River T	Siuslaw River M	Siuslaw River S	Umpqua River T	Umpqua River M	Umpqua River S	Coos Bay T	Coos Bay M	Coos Bay S	Rogue River T	Rogue River M	Rogue River S	Salinity Zone
Blue mussel	A			√			√			√			√			√			√			√			√	
Mytilus	J			√			√			√			√			√			√			√			√	
edulis	L			√			√			√			√			√			√			√				
Pacific oyster	A			√					√										√			√	√			
Crassostrea	J			√					√									√			√	√				
gigas	L																									
Horseneck gaper	A			√					√	√			√			√			√			√	√			
Tresus	J			√					√	√			√			√			√			√	√			
capax	L			√					√	√			√			√			√			√	√			
Pacific gaper	A			√						√																
Tresus	J			√						√																
nuttallii	L			√						√																
California jackknife clam	A																									
Tagelus	J																									
californianus	L																									
Pacific littleneck clam	A			√					√	√			√			√					√	√				
Protothaca	J			√					√	√			√			√					√	√				
staminea	L			√					√	√			√			√					√	√				
Manila clam	A			√						√												√				
Venerupis	J			√						√												√				
japonica	L			√																		√				
Softshell	A		√	√		√			√	√		√	√		√			√			√	√				
Mya	J		√	√		√			√	√		√	√		√			√			√	√				
arenaria	L		√	√		√			√	√		√	√		√			√			√	√				
Geoduck	A			√																						
Panopea	J			√																						
abrupta	L			√																						
Bay shrimp	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√				
Crangon	J		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√				
franciscorum	L		√	√		√	√		√	√		√	√		√	√		√	√		√	√				
Dungeness crab	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Cancer	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
magister	L			√			√			√			√			√			√			√	√				
Leopard shark	A																				√					
Triakis	J																									
semifasciata	P																									
Green sturgeon	A								√	√			√			√		√	√		√	√	√	√	√	
Acipenser	J								√	√			√			√		√	√		√	√	√	√	√	
medirostris	L																									
White sturgeon	A							√	√	√			√			√	√	√	√		√	√	√	√	√	
Acipenser	J							√	√	√			√			√	√	√	√		√	√	√	√	√	
transmontanus	L																									
American shad	A							√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Alosa	J							√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
sapidissima	L																			√						
Pacific herring	A		√	√					√	√		√	√		√	√		√	√		√	√			√	
Clupea	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
pallasi	L		√	√					√	√		√	√		√			√	√		√	√				
Deepbody anchovy	A																									
Anchoa	J																									
compressa	L																									
Slough anchovy	A																									
Anchoa	J																									
delicatissima	L																									
Northern anchovy	A			√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Engraulis	J			√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
mordax	L								√	√			√								√	√		√	√	
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River			

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Klamath River T	Klamath River M	Klamath River S	Humboldt Bay T	Humboldt Bay M	Humboldt Bay S	Eel River T	Eel River M	Eel River S	Tomales Bay T	Tomales Bay M	Tomales Bay S	Central San Francisco Bay[1] T	Central San Francisco Bay[1] M	Central San Francisco Bay[1] S	South San Francisco Bay *	South San Francisco Bay M	South San Francisco Bay S	Elkhorn Slough *	Elkhorn Slough *	Elkhorn Slough S	Morro Bay *	Morro Bay *	Morro Bay S	Salinity Zone
Blue mussel	A					√	√			√		√		√		√		√	√			√			√	
Mytilus	J					√	√			√		√		√		√		√	√			√			√	
edulis	L					√	√			√		√		√		√		√	√			√			√	
Pacific oyster	A					√	√					√				√			√			√			√	
Crassostrea	J					√	√					√				√			√			√			√	
gigas	L																									
Horseneck gaper	A					√	√																			
Tresus	J					√	√																			
capax	L					√	√																			
Pacific gaper	A					√	√					√				√			√			√			√	
Tresus	J					√	√					√				√			√			√			√	
nuttallii	L					√	√					√				√			√			√			√	
California jackknife clam	A											√				√						√			√	
Tagelus	J											√				√						√			√	
californianus	L											√				√						√			√	
Pacific littleneck clam	A					√	√					√				√			√			√			√	
Protothaca	J					√	√					√				√			√			√			√	
staminea	L					√	√					√				√			√			√			√	
Manila clam	A					√	√					√		√		√		√	√			√				
Venerupis	J					√	√					√		√		√		√	√			√				
japonica	L					√	√					√		√		√		√	√							
Softshell	A					√	√		√			√		√		√		√	√			√			√	
Mya	J					√	√		√			√		√		√		√	√			√			√	
arenaria	L					√	√		√			√		√		√		√	√			√			√	
Geoduck	A						√																		√	
Panopea	J						√																		√	
abrupta	L						√																		√	
Bay shrimp	A						√		√	√		√			√	√		√	√							
Crangon	J					√	√	√	√	√		√		√	√	√		√	√							
franciscorum	L					√	√		√	√		√			√	√		√	√							
Dungeness crab	A		√	√		√	√		√	√		√			√	√		√	√			√			√	
Cancer	J		√	√		√	√		√	√		√		√	√	√		√	√			√			√	
magister	L						√			√		√		√	√	√		√	√			√				
Leopard shark	A					√	√					√			√	√		√	√			√			√	
Triakis	J					√	√					√		√	√	√		√	√			√			√	
semifasciata	P						√					√			√	√		√	√			√			√	
Green sturgeon	A	√	√	√		√	√	√	√	√				√	√	√		√	√							
Acipenser	J	√	√	√		√	√	√	√	√				√	√	√		√	√							
medirostris	L													√												
White sturgeon	A			√										√	√	√		√	√							
Acipenser	J	√	√	√			√			√				√	√	√		√	√							
transmontanus	L													√												
American shad	A	√	√	√				√	√	√				√	√	√										
Alosa	J	√	√	√			√	√	√	√				√	√	√		√	√							
sapidissima	L																									
Pacific herring	A			√		√	√		√	√		√			√			√			√				√	
Clupea	J		√	√		√	√		√	√		√			√	√		√	√		√				√	
pallasi	L					√	√		√	√		√			√	√		√	√		√					
Deepbody anchovy	A																									
Anchoa	J																									
compressa	L																									
Slough anchovy	A																									
Anchoa	J																									
delicatissima	L																									
Northern anchovy	A		√	√		√	√		√	√		√			√	√		√	√			√			√	
Engraulis	J		√	√		√	√		√	√		√			√	√		√	√			√			√	
mordax	L			√								√			√	√		√	√			√			√	
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S	
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Central San Francisco Bay[1]			South San Francisco Bay			Elkhorn Slough			Morro Bay			

[1] Includes San Pablo and Suisun Bays.

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary			Salinity Zone
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	
Blue mussel	A			√			√			√			√			√			√			√			√	
Mytilus	J			√			√			√			√			√			√			√			√	
edulis	L			√			√			√			√			√			√			√			√	
Pacific oyster	A																									
Crassostrea	J																									
gigas	L																									
Horseneck gaper	A																									
Tresus	J																									
capax	L																									
Pacific gaper	A			√			√			√			√			√			√			√			√	
Tresus	J			√			√			√			√			√			√			√			√	
nuttallii	L			√			√			√			√			√			√			√			√	
California jackknife clam	A			√			√			√			√			√			√			√			√	
Tagelus	J			√			√			√			√			√			√			√			√	
californianus	L			√			√			√			√			√			√			√			√	
Pacific littleneck clam	A			√			√			√			√			√			√			√			√	
Protothaca	J			√			√			√			√			√			√			√			√	
staminea	L			√			√			√			√			√			√			√			√	
Manila clam	A																									
Venerupis	J																									
japonica	L																									
Softshell	A																									
Mya	J																									
arenaria	L																									
Geoduck	A						√																			
Panopea	J						√																			
abrupta	L						√																			
Bay shrimp	A																									
Crangon	J																									
franciscorum	L																									
Dungeness crab	A																									
Cancer	J																									
magister	L																									
Leopard shark	A			√			√			√			√			√			√			√				
Triakis	J			√			√			√			√			√			√			√				
semifasciata	P			√			√																			
Green sturgeon	A																									
Acipenser	J																									
medirostris	L																									
White sturgeon	A																									
Acipenser	J																									
transmontanus	L																									
American shad	A																									
Alosa	J																									
sapidissima	L																									
Pacific herring	A			√			√																			
Clupea	J			√			√																			
pallasi	L																									
Deepbody anchovy	A			√			√			√			√			√			√			√				
Anchoa	J			√			√			√			√			√			√			√				
compressa	L									√			√			√			√			√				
Slough anchovy	A						√			√			√			√			√			√			√	
Anchoa	J						√			√			√			√			√			√			√	
delicatissima	L									√						√			√			√				
Northern anchovy	A			√			√			√			√			√						√				
Engraulis	J			√			√			√			√			√						√				
mordax	L			√			√			√			√			√			√			√			√	
		*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	*	*	S	
		Santa Monica Bay			San Pedro Bay			Alamitos Bay			Anaheim Bay			Newport Bay			Mission Bay			San Diego Bay			Tijuana Estuary			

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 2/91).

Species		Puget Sound T	Puget Sound M	Puget Sound S	Hood Canal T	Hood Canal M	Hood Canal S	Skagit Bay T	Skagit Bay M	Skagit Bay S	Grays Harbor T	Grays Harbor M	Grays Harbor S	Willapa Bay T	Willapa Bay M	Willapa Bay S	Columbia River T	Columbia River M	Columbia River S	Nehalem Bay T	Nehalem Bay M	Nehalem Bay S	Tillamook Bay T	Tillamook Bay M	Tillamook Bay S
Cutthroat trout	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
clarki	L																								
Pink salmon	A	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√						
Oncorhynchus	J	√	√	√	√	√	√	√	√	√															
gorbuscha	L				√																				
Chum salmon	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
keta	L																								
Coho salmon	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
kisutch	L																								
Steelhead - fall	A																								
Oncorhynchus	J																								
mykiss (F)	L																								
Steelhead - half pounder	A																								
Oncorhynchus	J																								
mykiss (H)	L																								
Steelhead - summer	A	√	√	√	√	√	√	√	√	√							√	√	√				√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√							√	√	√				√	√	√
mykiss (S)	L																								
Steelhead - winter	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
mykiss (W)	L																								
Sockeye salmon	A	√	√	√				√	√	√							√	√	√						
Oncorhynchus	J	√	√	√				√	√	√							√	√	√						
nerka	L																								
Chinook salmon - fall	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
tshawytscha (F)	L																								
Chinook salmon - late fall	A																								
Oncorhynchus	J																								
tshawytscha (LF)	L																								
Chinook salmon - winter	A																								
Oncorhynchus	J																								
tshawytscha (W)	L																								
Chinook salmon - spring	A	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√				√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√				√	√	√
tshawytscha (Sp)	L																								
Chinook salmon - summer	A																√	√	√						
Oncorhynchus	J																√	√	√						
tshawytscha (Su)	L																								
Surf smelt	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
Hypomesus	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
pretiosus	L		√	√		√			√	√		√	√		√	√		√	√		√	√			√
Longfin smelt	A		√	√					√	√		√	√		√	√		√	√						√
Spirinchus	J		√	√					√	√		√	√		√	√		√	√						
thaleichthys	L		√	√					√	√	√	√	√	√	√	√	√	√	√						
Eulachon	A			√						√	√	√	√	√	√	√	√	√	√						
Thaleichthys	J																								
pacificus	L										√	√	√	√	√	√	√	√	√						
Pacific tomcod	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
Microgadus	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
proximus	L		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
Topsmelt	A												√			√			√			√		√	√
Atherinops	J												√			√			√			√		√	√
affinis	L																								
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Puget Sound			Hood Canal			Skagit Bay			Grays Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay		

Salinity Zone

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Netarts Bay T	Netarts Bay M	Netarts Bay S	Siletz River T	Siletz River M	Siletz River S	Yaquina Bay T	Yaquina Bay M	Yaquina Bay S	Alsea River T	Alsea River M	Alsea River S	Siuslaw River T	Siuslaw River M	Siuslaw River S	Umpqua River T	Umpqua River M	Umpqua River S	Coos Bay T	Coos Bay M	Coos Bay S	Rogue River T	Rogue River M	Rogue River S
Cutthroat trout	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
clarki	L																								
Pink salmon	A							√	√	√	√	√	√										√	√	√
Oncorhynchus	J																								
gorbuscha	L																								
Chum salmon	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√			√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√			
keta	L																								
Coho salmon	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
kisutch	L																								
Steelhead - fall	A																								
Oncorhynchus	J																								
mykiss (F)	L																								
Steelhead - half pounder	A																						√	√	√
Oncorhynchus	J																								
mykiss (H)	L																								
Steelhead - summer	A				√	√	√				√	√	√				√	√	√				√	√	√
Oncorhynchus	J				√	√	√				√	√	√				√	√	√				√	√	√
mykiss (S)	L																								
Steelhead - winter	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
mykiss (W)	L																								
Sockeye salmon	A																								
Oncorhynchus	J																								
nerka	L																								
Chinook salmon - fall	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
tshawytscha (F)	L																								
Chinook salmon - late fall	A																								
Oncorhynchus	J																								
tshawytscha (LF)	L																								
Chinook salmon - winter	A																								
Oncorhynchus	J																								
tshawytscha (W)	L																								
Chinook salmon - spring	A				√	√	√	√	√	√	√	√	√				√	√	√	√	√	√	√	√	√
Oncorhynchus	J				√	√	√	√	√	√	√	√	√				√	√	√	√	√	√	√	√	√
tshawytscha (Sp)	L																								
Chinook salmon - summer	A																								
Oncorhynchus	J																								
tshawytscha (Su)	L																								
Surf smelt	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√			√
Hypomesus	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
pretiosus	L			√			√			√			√			√			√			√			√
Longfin smelt	A							√	√	√			√			√			√	√	√	√	√	√	
Spirinchus	J								√	√			√			√			√		√	√	√	√	
thaleichthys	L							√												√	√	√			
Eulachon	A															√	√	√	√			√	√	√	√
Thaleichthys	J																								
pacificus	L																√	√	√						
Pacific tomcod	A					√	√		√	√		√	√		√	√		√	√		√	√		√	√
Microgadus	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√
proximus	L			√					√	√		√	√		√	√		√	√						
Topsmelt	A		√	√					√	√		√	√		√	√			√		√	√			
Atherinops	J		√	√					√	√		√	√		√	√			√		√	√			
affinis	L		√	√					√	√		√	√		√	√					√	√			
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River		

Salinity Zone

Legend:

T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Klamath River T	Klamath River M	Klamath River S	Humboldt Bay T	Humboldt Bay M	Humboldt Bay S	Eel River T	Eel River M	Eel River S	Tomales Bay T	Tomales Bay M	Tomales Bay S	Central San Francisco Bay[1] T	Central San Francisco Bay[1] M	Central San Francisco Bay[1] S	South San Francisco Bay *	South San Francisco Bay M	South San Francisco Bay S	Elkhorn Slough *	Elkhorn Slough *	Elkhorn Slough S	Morro Bay *	Morro Bay *	Morro Bay S
Cutthroat trout	A	√	√	√	√	√	√	√	√	√															
Oncorhynchus	J	√	√	√	√	√	√	√	√	√															
clarki	L																								
Pink salmon	A	√	√	√									√												
Oncorhynchus	J																								
gorbuscha	L																								
Chum salmon	A	√	√	√			√	√	√	√															
Oncorhynchus	J	√	√	√																					
keta	L																								
Coho salmon	A	√	√	√	√	√	√	√	√	√	√	√	√												
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√												
kisutch	L																								
Steelhead - fall	A	√	√	√																					
Oncorhynchus	J	√	√	√																					
mykiss (F)	L																								
Steelhead - half pounder	A																								
Oncorhynchus	J	√	√	√				√	√	√															
mykiss (H)	L																								
Steelhead - summer	A	√	√	√				√	√	√															
Oncorhynchus	J	√	√	√				√	√	√															
mykiss (S)	L																								
Steelhead - winter	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√									√
Oncorhynchus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√									√
mykiss (W)	L																								
Sockeye salmon	A																								
Oncorhynchus	J																								
nerka	L																								
Chinook salmon - fall	A	√	√	√	√	√	√	√	√	√				√	√	√			√						
Oncorhynchus	J	√	√	√	√	√	√	√	√	√				√	√	√			√						
tshawytscha (F)	L																								
Chinook salmon - late fall	A													√	√	√			√						
Oncorhynchus	J													√	√	√			√						
tshawytscha (LF)	L																								
Chinook salmon - winter	A													√	√	√									
Oncorhynchus	J													√	√	√			√						
tshawytscha (W)	L																								
Chinook salmon - spring	A	√	√	√										√	√	√			√						
Oncorhynchus	J	√	√	√										√	√	√			√						
tshawytscha (Sp)	L																								
Chinook salmon - summer	A																								
Oncorhynchus	J																								
tshawytscha (Su)	L																								
Surf smelt	A			√		√	√		√	√			√		√	√			√						
Hypomesus	J		√	√		√	√		√	√			√		√	√			√			√			
pretiosus	L					√	√		√	√			√												
Longfin smelt	A			√	√	√	√	√	√	√				√	√	√		√	√						
Spirinchus	J			√		√	√		√	√				√	√	√		√	√						
thaleichthys	L				√	√	√	√	√	√				√	√	√		√	√						
Eulachon	A	√	√	√			√																		
Thaleichthys	J																								
pacificus	L	√	√	√																					
Pacific tomcod	A					√	√						√		√	√		√	√						
Microgadus	J			√		√	√			√			√		√	√		√	√			√			
proximus	L																								
Topsmelt	A					√	√		√	√			√		√	√		√	√			√			√
Atherinops	J					√	√		√	√			√		√	√		√	√			√			√
affinis	L					√	√		√	√			√		√	√		√	√			√			√
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Central San Francisco Bay[1]			South San Francisco Bay			Elkhorn Slough			Morro Bay		

Salinity Zone

[1] Includes San Pablo and Suisun Bays.

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adults
J = Juveniles
L = Larvae

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Santa Monica Bay * * S	San Pedro Bay * * S	Alamitos Bay * * S	Anaheim Bay * * S	Newport Bay * * S	Mission Bay * * S	San Diego Bay * * S	Tijuana Estuary * * S	Salinity Zone
Cutthroat trout	A									
Oncorhynchus	J									
clarki	L									
Pink salmon	A									
Oncorhynchus	J									
gorbuscha	L									
Chum salmon	A									
Oncorhynchus	J									
keta	L									
Coho salmon	A									
Oncorhynchus	J									
kisutch	L									
Steelhead - fall	A									
Oncorhynchus	J									
mykiss (F)	L									
Steelhead - half pounder	A									
Oncorhynchus	J									
mykiss (H)	L									
Steelhead - summer	A									
Oncorhynchus	J									
mykiss (S)	L									
Steelhead - winter	A									
Oncorhynchus	J									
mykiss (W)	L									
Sockeye salmon	A									
Oncorhynchus	J									
nerka	L									
Chinook salmon - fall	A	√								
Oncorhynchus	J									
tshawytscha (F)	L									
Chinook salmon - late fall	A									
Oncorhynchus	J									
tshawytscha (LF)	L									
Chinook salmon - winter	A									
Oncorhynchus	J									
tshawytscha (W)	L									
Chinook salmon - spring	A									
Oncorhynchus	J									
tshawytscha (Sp)	L									
Chinook salmon - summer	A									
Oncorhynchus	J									
tshawytscha (Su)	L									
Surf smelt	A									
Hypomesus	J									
pretiosus	L									
Longfin smelt	A									
Spirinchus	J									
thaleichthys	L									
Eulachon	A									
Thaleichthys	J									
pacificus	L									
Pacific tomcod	A									
Microgadus	J									
proximus	L									
Topsmelt	A	√	√	√	√	√	√	√	√	
Atherinops	J	√	√	√	√	√	√	√	√	
affinis	L	√	√	√	√	√	√	√	√	
		* * S	* * S	* * S	* * S	* * S	* * S	* * S	* * S	
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary	

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adults
J = Juveniles
L = Larvae

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Puget Sound T	Puget Sound M	Puget Sound S	Hood Canal T	Hood Canal M	Hood Canal S	Skagit Bay T	Skagit Bay M	Skagit Bay S	Grays Harbor T	Grays Harbor M	Grays Harbor S	Willapa Bay T	Willapa Bay M	Willapa Bay S	Columbia River T	Columbia River M	Columbia River S	Nehalem Bay T	Nehalem Bay M	Nehalem Bay S	Tillamook Bay T	Tillamook Bay M	Tillamook Bay S	Salinity Zone
Jacksmelt	A																									
Atherinopsis	J																									
californiensis	L																									
Threespine stickleback	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	
Gasterosteus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	
aculeatus	L	√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√		
Striped bass	A			√						√																
Morone	J																									
saxatilis	L																									
Kelp bass	A																									
Paralabrax	J																									
clathratus	L																									
Barred sand bass	A																									
Paralabrax	J																									
nebulifer	L																									
White seabass	A									√																
Atractoscion	J																									
nobilis	L																									
White croaker	A																									
Genyonemus	J																									
lineatus	L																									
Shiner perch	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Cymatogaster	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
aggregata	P		√			√			√			√			√			√			√			√	√	
Pacific sand lance	A		√	√		√	√		√	√			√			√		√	√		√	√		√	√	
Ammodytes	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
hexapterus	L		√	√		√	√		√	√		√	√		√	√		√	√		√				√	
Arrow goby	A		√	√		√	√		√	√		√	√		√	√									√	
Clevelandia	J		√	√		√	√		√	√		√	√		√	√									√	
ios	L		√	√		√	√		√	√		√	√		√	√										
Lingcod	A			√			√			√																
Ophiodon	J		√	√		√	√		√	√		√	√		√	√		√	√		√			√	√	
elongatus	L		√	√		√	√		√	√		√	√		√	√										
Pacific staghorn sculpin	A		√	√		√	√		√	√		√	√		√	√	√	√	√		√	√		√	√	
Leptocottus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
armatus	L		√	√		√	√		√	√			√			√		√	√		√	√			√	
California halibut	A																									
Paralichthys	J																									
californicus	L																									
Diamond turbot	A																									
Hypsopsetta	J																									
guttulata	L																									
English sole	A			√			√			√																
Pleuronectes	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
vetulus	L		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Starry flounder	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Platichthys	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
stellatus	L		√	√		√	√		√	√		√	√		√	√		√			√	√		√	√	
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	
		Puget Sound			Hood Canal			Skagit Bay			Grays Harbor			Willapa Bay			Columbia River			Nehalem Bay			Tillamook Bay			

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Netarts Bay T	Netarts Bay M	Netarts Bay S	Siletz River T	Siletz River M	Siletz River S	Yaquina Bay T	Yaquina Bay M	Yaquina Bay S	Alsea River T	Alsea River M	Alsea River S	Siuslaw River T	Siuslaw River M	Siuslaw River S	Umpqua River T	Umpqua River M	Umpqua River S	Coos Bay T	Coos Bay M	Coos Bay S	Rogue River T	Rogue River M	Rogue River S	Salinity Zone
Jacksmelt	A									√											√	√				
Atherinopsis	J									√											√	√				
californiensis	L																									
Threespine stickleback	A		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Gasterosteus	J		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
aculeatus	L		√		√	√		√	√		√	√		√	√		√	√		√	√		√	√			
Striped bass	A						√			√				√			√	√	√	√	√						
Morone	J													√			√	√	√	√	√						
saxatilis	L													√			√			√							
Kelp bass	A																									
Paralabrax	J																									
clathratus	L																									
Barred sand bass	A																									
Paralabrax	J																									
nebulifer	L																									
White seabass	A									√												√				
Atractoscion	J																									
nobilis	L																									
White croaker	A																									
Genyonemus	J																									
lineatus	L																									
Shiner perch	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Cymatogaster	J		√	√		√	√	√	√	√	√	√	√		√	√		√	√		√	√		√	√	
aggregata	P		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Pacific sand lance	A			√			√			√			√			√			√			√				
Ammodytes	J			√			√			√			√			√			√			√				
hexapterus	L			√			√			√			√			√			√			√				
Arrow goby	A			√					√	√					√			√	√		√	√				
Clevelandia	J			√					√						√			√	√		√	√				
ios	L								√												√	√				
Lingcod	A									√												√				
Ophiodon	J			√						√			√			√			√		√	√				
elongatus	L																					√				
Pacific staghorn sculpin	A		√	√		√	√		√	√		√	√		√	√		√	√		√	√		√	√	
Leptocottus	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	
armatus	L			√			√			√			√			√			√			√			√	
California halibut	A																									
Paralichthys	J																									
californicus	L																									
Diamond turbot	A																									
Hypsopsetta	J																									
guttulata	L																									
English sole	A																									
Pleuronectes	J		√	√		√	√		√	√		√	√		√	√		√	√		√	√			√	
vetulus	L			√			√			√						√			√			√				
Starry flounder	A					√	√		√	√		√	√		√	√		√	√		√	√				
Platichthys	J		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
stellatus	L		√	√		√	√		√	√			√			√			√			√				√
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	
		Netarts Bay			Siletz River			Yaquina Bay			Alsea River			Siuslaw River			Umpqua River			Coos Bay			Rogue River			

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Klamath River T	Klamath River M	Klamath River S	Humboldt Bay T	Humboldt Bay M	Humboldt Bay S	Eel River T	Eel River M	Eel River S	Tomales Bay T	Tomales Bay M	Tomales Bay S	Central San Francisco Bay[1] T	Central San Francisco Bay[1] M	Central San Francisco Bay[1] S	South San Francisco Bay *	South San Francisco Bay M	South San Francisco Bay S	Elkhorn Slough *	Elkhorn Slough *	Elkhorn Slough S	Morro Bay *	Morro Bay *	Morro Bay S	Salinity Zone
Jacksmelt	A					√	√					√			√	√		√	√			√			√	
Atherinopsis	J					√	√					√			√	√		√	√			√			√	
californiensis	L					√	√					√			√	√		√	√			√			√	
Threespine stickleback	A	√	√	√	√	√	√	√	√	√		√		√	√	√		√	√			√			√	
Gasterosteus	J	√	√	√	√	√	√	√	√	√		√		√	√	√		√	√			√			√	
aculeatus	L	√	√		√	√		√	√			√		√	√			√								
Striped bass	A			√								√		√	√	√		√	√							
Morone	J													√	√	√		√	√							
saxatilis	L													√	√											
Kelp bass	A																									
Paralabrax	J																									
clathratus	L																									
Barred sand bass	A																									
Paralabrax	J																									
nebulifer	L																									
White seabass	A					√					√				√			√								
Atractoscion	J					√					√			√	√			√								
nobilis	L																									
White croaker	A					√					√			√	√		√	√								
Genyonemus	J					√					√			√	√		√	√								
lineatus	L										√			√	√		√	√		√						
Shiner perch	A		√	√		√	√		√	√	√			√	√		√	√		√			√			
Cymatogaster	J		√	√		√	√		√	√	√			√	√		√	√		√			√			
aggregata	P		√	√		√	√		√	√	√			√	√		√	√		√			√			
Pacific sand lance	A						√			√	√				√			√		√						
Ammodytes	J						√			√	√				√			√		√						
hexapterus	L						√				√															
Arrow goby	A					√	√				√				√	√		√	√		√			√		
Clevelandia	J					√	√				√				√	√		√	√		√			√		
ios	L					√	√				√				√	√		√	√		√			√		
Lingcod	A						√																			
Ophiodon	J					√	√				√				√	√		√			√			√		
elongatus	L						√				√					√										
Pacific staghorn sculpin	A		√	√		√	√		√	√	√				√	√		√	√		√			√		
Leptocottus	J		√	√		√	√		√	√	√			√	√	√		√	√		√			√		
armatus	L			√			√			√	√				√	√		√	√		√			√		
California halibut	A														√	√		√	√		√			√		
Paralichthys	J						√				√			√	√	√		√	√		√			√		
californicus	L										√					√			√		√			√		
Diamond turbot	A										√					√		√	√		√			√		
Hypsopsetta	J										√				√	√		√	√		√			√		
guttulata	L										√							√	√							
English sole	A																									
Pleuronectes	J			√		√	√		√	√	√				√	√		√			√			√		
vetulus	L					√	√			√	√				√	√		√			√			√		
Starry flounder	A					√	√			√	√				√	√		√	√		√					
Platichthys	J	√	√	√	√	√	√	√	√	√	√			√	√	√		√	√		√			√		
stellatus	L			√		√	√			√	√				√	√		√	√							
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S	*	*	S	*	*	S	
		Klamath River			Humboldt Bay			Eel River			Tomales Bay			Central San Francisco Bay[1]			South San Francisco Bay			Elkhorn Slough			Morro Bay			

[1] Includes San Pablo and Suisun Bays.

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone not present

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Table 5, continued. Presence/absence of 47 species in west coast estuaries (revised 1/91).

Species		Santa Monica Bay * * S	San Pedro Bay * * S	Alamitos Bay * * S	Anaheim Bay * * S	Newport Bay * * S	Mission Bay * * S	San Diego Bay * * S	Tijuana Estuary * * S	Salinity Zone
Jacksmelt	A	√	√			√	√	√		
Atherinopsis	J	√	√			√	√	√		
californiensis	L	√	√				√	√		
Threespine stickleback	A									
Gasterosteus	J									
aculeatus	L									
Striped bass	A	√				√	√			
Morone	J									
saxatilis	L									
Kelp bass	A	√	√	√	√	√	√	√	√	
Paralabrax	J	√	√	√	√	√	√	√	√	
clathratus	L	√	√				√	√		
Barred sand bass	A	√	√	√	√	√	√	√	√	
Paralabrax	J	√	√	√	√	√	√	√	√	
nebulifer	L	√	√				√	√		
White seabass	A	√	√					√		
Atractoscion	J	√	√		√	√	√	√	√	
nobilis	L	√	√							
White croaker	A	√	√	√	√	√	√	√	√	
Genyonemus	J	√	√	√	√	√	√	√	√	
lineatus	L	√	√	√	√	√	√	√	√	
Shiner perch	A	√	√	√	√	√	√	√	√	
Cymatogaster	J	√	√	√	√	√	√	√	√	
aggregata	P	√	√	√	√	√	√	√		
Pacific sand lance	A									
Ammodytes	J									
hexapterus	L									
Arrow goby	A	√	√	√	√	√	√	√	√	
Clevelandia	J	√	√	√	√	√	√	√	√	
ios	L		√	√	√	√	√	√	√	
Lingcod	A	√	√							
Ophiodon	J	√	√							
elongatus	L									
Pacific staghorn sculpin	A	√	√	√	√		√	√	√	
Leptocottus	J	√	√	√	√	√	√	√	√	
armatus	L	√		√	√		√	√	√	
California halibut	A	√	√		√	√	√	√	√	
Paralichthys	J	√	√	√	√	√	√	√	√	
californicus	L	√	√			√				
Diamond turbot	A	√	√	√	√	√	√	√	√	
Hypsopsetta	J	√	√	√	√	√	√	√	√	
guttulata	L	√	√	√	√		√	√	√	
English sole	A	√	√							
Pleuronectes	J	√	√							
vetulus	L	√	√							
Starry flounder	A									
Platichthys	J									
stellatus	L									
		* * S	* * S	* * S	* * S	* * S	* * S	* * S	* * S	
		Santa Monica Bay	San Pedro Bay	Alamitos Bay	Anaheim Bay	Newport Bay	Mission Bay	San Diego Bay	Tijuana Estuary	

Legend:
T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adults
J = Juveniles
L = Larvae
P = Parturition

√ = Species / lifestage is present
Blank = Species / lifestage is not present

Appendices

Appendix 1. National Estuarine Inventory map of Grays Harbor estuary

Appendix 2. Species profile and sample data sheet: Pacific herring

Appendix 3. Table of references and personal communications

Appendix 4. Personal communications

Appendix 5. References

Appendix 1. National Estuarine Inventory map of Grays Harbor

National Estuarine Atlas

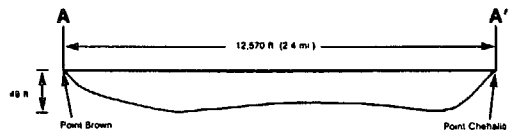
PHYSICAL AND HYDROLOGIC CHARACTERISTICS

PHYSICAL		FRESHWATER INFLOW			TIDAL DATA		
Surface Areas (mi^2)		*Flow Rates (1000 cfs)*			Prevailing Tide: Semi-diurnal		
Fluvial Drainage	1,310	Period of Record		1971-1982	Tidal Prism (cf)		1.35×10^{10}
Estuarine Drainage	1,408				*Phase Range of Tide (ft.)*		
Estuarine Zones		Long Term Average Daily		13.5	Map Key	Station	Range
Tidal Fresh	1	Long Term Average Monthly	J 26.8	J 27	A	939	6.8
Mixing Zone	34		F 26.4	A 20	B	945	7.5
Seawater	23		M 20.5	S 3.0			
Total	58		A 14.1	O 8.9			
Dimensions			M 7.1	N 17.7			
Length (mi.)	33.0		J 4.4	D 31.2			
Width (mi.) Average	5.4	7-Day, 10-Year Low Flow		0.8			
Minimum	0.5						
Maximum	11.4						
Average Depth (ft.)	14.0	50-Year Flood		150.0			
Average Depth to Width Ratio	4.9×10^{-4}	100-Year Flood		163.8			
Stratification Classification		*Flow Ratios*					
		Average Annual		0.045			
3-Month High Flow	MS	High Flow Period		0.093			
3-Month Low Flow	MS	Low Flow Period		0.008			

Abbreviations: Vertically Homogeneous, VH; Moderately Stratified, MS; Highly Stratified, HS

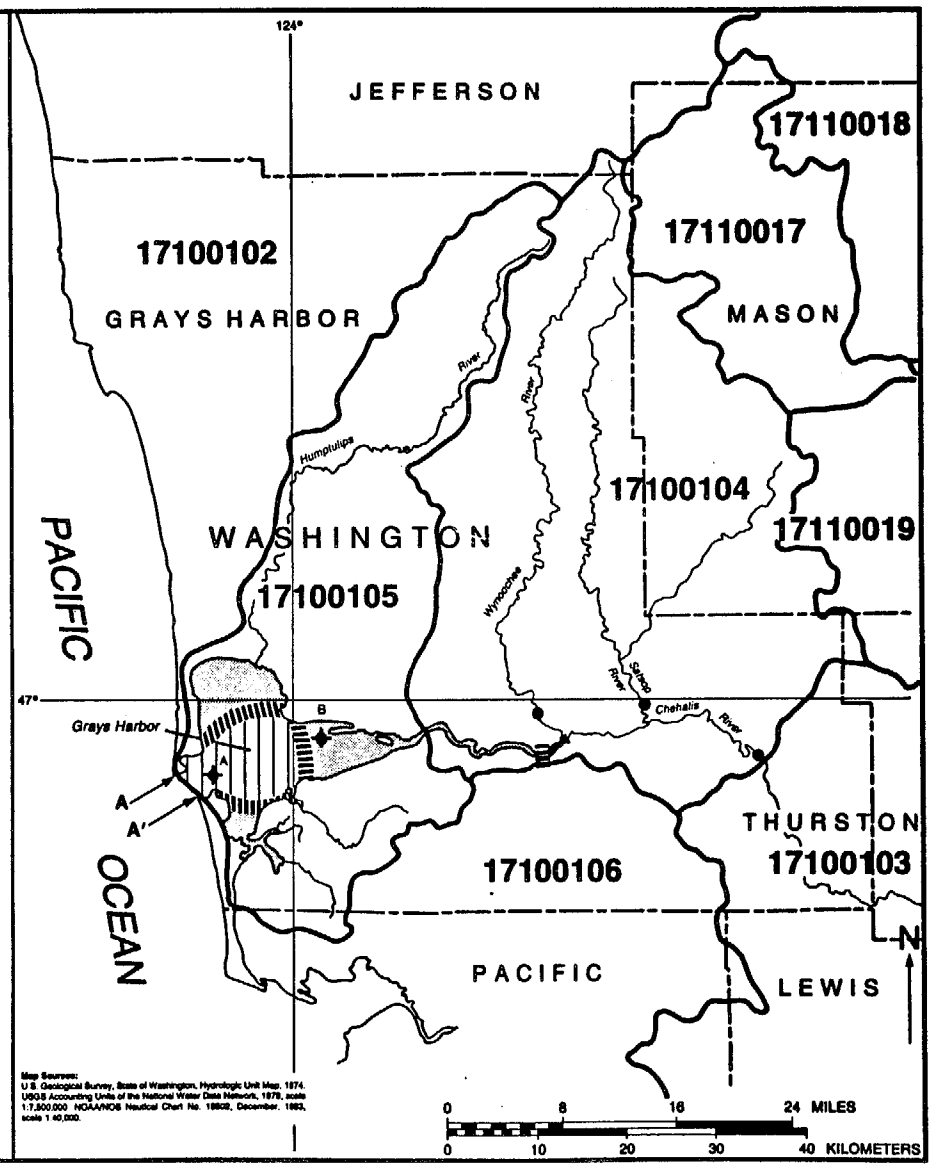
Cross Section
(at mean high water)

Scale Ratio: 25 : 1



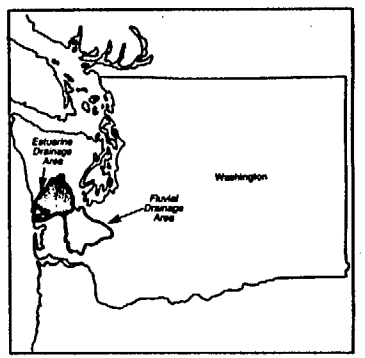
Notes:
One hundred percent of Estuarine Drainage Area is shown on map.

References:
Cummans, et al., 1975. Loehr and Collias, 1980. Smith, et al., 1976. U.S. Department of Commerce, 1983a. U.S. Geological Survey, 1985.



Map Sources:
U.S. Geological Survey, State of Washington, Hydrologic Unit Map, 1974. USGS Accounting Units of the National Water Data Network, 1979, scale 1:7,500,000. NOAA/NOS Nautical Chart No. 18502, December, 1983, scale 1:80,000.

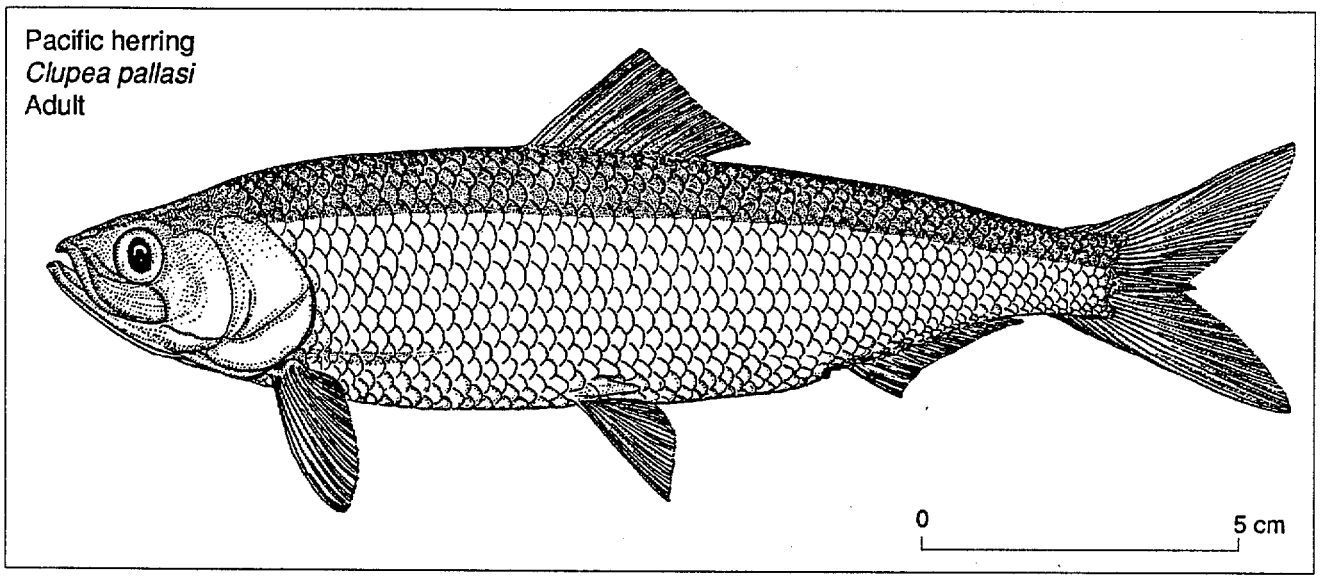
Grays Harbor WA



- Tide Gage
- Flow Gage
- Head of Tide
- Estuarine Drainage Area (EDA)
- Tidal Fresh Zone
- Mixing Zone
- Seawater Zone
- Hydrologic Cataloging Unit Boundary
- County Boundary
- Salinity Zone Boundary - Low Variability
- Salinity Zone Boundary - Moderate Variability
- Salinity Zone Boundary - High Variability

Strategic Assessment Branch
Ocean Assessments Division
Office of Oceanography and Marine Assessment
National Ocean Service / NOAA

Appendix 2. Pacific herring species profile.



Common Name: Pacific herring
Scientific Name: *Clupea pallasi* Valenciennes
Other Common Names: California herring, Ches-Pechora herring, eastern herring, herring, Kara herring, Pacific Ocean herring, seld, white sea herring.

Classification

Phylum: Chordata
Class: Osteichthyes
Order: Clupeiformes
Family: Clupeidae (Robins et al. 1980)

Value

Commercial: Pacific herring has a long history of exploitation. It has been sold fresh or salted and also used for fish meal. Since 1965 the fishery has concentrated on gravid females for roe (eggs), which are exported primarily to Japan. Presently, over 90% of the Pacific herring caught are in the roe fishery. Fishermen take advantage of Pacific herring's natural spawning cycle by fishing in nearshore areas where and when it spawns. They are primarily caught by purse seine and gill net. Recent U.S. annual harvests have been 116 million pounds, worth $47 million (Thompson 1986). The San Francisco and Tomales Bay fishery alone is worth $11 million (Suer 1987). Most U.S. harvest comes from Alaska, California, and Washington. Since spawning adults are highly vulnerable to overfishing, the fishery is strictly regulated (Grosse and Hay 1989). Commercial bait fisheries, which harvest juveniles, exist in Puget Sound and other West Coast estuaries (Trumble 1983).

Recreational: Used as bait for Pacific salmon (*Oncorhynchus* spp.) and other fishes. However, some are caught for human consumption.

Indicator of Environmental Stress: Herring larvae appear to have high mortality rates in oil-contaminated water (Nelson-Smith 1973). Populations show wide fluctuations in abundance, which is apparently related to environmental conditions (see Factors Influencing Populations), and are affected by alterations of bays and estuaries (spawning habitats).

Ecological: Seasonally, Pacific herring is one of the most abundant species in West Coast marine and estuarine neritic zones. Juveniles are highly abundant in many West Coast estuaries in summer. They are important prey for many marine species (Pacific salmon, seals, gulls, etc.).

Range

Overall: Arctic-circumboreal. In the eastern Pacific it ranges from Ensenada, Baja California, to St. Michael Island and to Cape Bathurst in the Beaufort Sea (Hart 1973). Also found in Arctic waters from Coronation Gulf, Canada to the Chuckchi Sea and the USSR Arctic. In the Western Pacific it is found to Toyama Bay, Japan, west to Korea and the Yellow Sea (Haegele and Schweigert 1985; Wang 1986).

Within Study Area: Found in most West Coast estuaries north of San Diego, California, but occurs primarily north of Point Conception.

Life Mode

Eggs are adhesive after fertilization and attach to benthic substrates. Larvae, juveniles, and adults are schooling, pelagic, and nektonic.

Habitat

Type: Eggs are laid in intertidal (3.7 m above mean lowest low water) and subtidal areas (to 20 m), but normally occur in +1 to -2 m depth. Larvae and

juveniles are neritic while adults are neritic-oceanic (Eldridge and Kaill 1973; Suer 1987).

Substrate: Eggs occur on eelgrass, algae, tube worms, oysters, hydroids, driftwood, pilings, brush, rocks, and rocky-sandy bottoms (Garrison and Miller 1982). Larvae, juveniles, and adults occur in the water column.

Physical/Chemical Characteristics: Eggs can tolerate temperatures of 5-14°C and salinities of 3-33 ‰ (Haegele and Schweigert 1985). Larvae are tolerant of salinities ranging from 2-28 ‰ (Alderdice and Velsen 1971; Alderdice and Hourston 1985). Best spawning salinities in British Columbia are 27-28.7 ‰. (Alderdice and Hourston 1985). Optimum temperatures and salinities for egg and larva survival appear to be 5.5-8.7°C and 13-19 ‰ (Alderdice and Velsen 1971). However, in California spawning temperatures are normally above 9°C (Barnhart 1988). Salinity tolerances of larvae are affected by salinity and temperature during egg incubation (Alderdice and Hourston 1985). Turbidity in estuaries may increase larval survival (Boehlert and Morgan 1985).

Migrations and Movements: A schooling fish, Pacific herring does not make extensive coastal migrations but moves onshore and offshore in association with spawning and feeding (Morrow 1980). Adults typically move onshore during winter and early spring, residing in "holding" areas before moving to adjacent spawning grounds. The Pacific herring population consists of many discrete stocks (Grosse and Hay 1989). However, offshore distributions of adults for many West Coast stocks are unknown (Barnhart 1988). Pacific herring return to natal spawning grounds to spawn. Larvae are easily dispersed by currents, but their behavior and local currents often retain them in specific areas. Juveniles usually stay in nearshore shallow-water areas until fall when they disperse to deeper offshore waters. However, they may reside year-round in some estuaries (San Francisco Bay) (Wang 1986). Adult Pacific herring are found down to 100-150 m, with vertical distribution apparently controlled by temperature (Grosse and Hay 1989). Larvae, juveniles, and adults move toward the surface to feed at dawn and dusk (Grosse and Hay 1989).

Reproduction

Mode: Sexual, separate sexes, oviparous, iteroparous, spawning annually after reaching maturity.

Spawning: Spawning time ranges from November in the southern part of its range to August in the far north. Spawning peaks in December-January in California (Spratt 1981) and February-March in Puget Sound (Trumble 1983). Herring spawn in particular areas every year. These are high-energy areas, located in protected coastal habitats or bays and estuaries, and are usually influenced by freshwater. Spawning apparently does not occur until a tactile stimulus (a storm, contact with bottom or other fish) causes some males to extrude milt, which in turn stimulates the entire school to spawn. During spawning both sexes come in contact with the spawning substrate (Haegele and Schweigert 1985). Most spawning occurs at night (Eldridge and Kaill 1973; Suer 1987).

Fertilization and Fecundity: External; fecundity increases with female size and ranges from 4,000 to 134,000 eggs/female (Hart 1973). Fecundity is 227 and 220 eggs/gram of female weight in Tomales Bay and San Francisco Bay, respectively (Hardwick 1973; Rabin and Barnhart 1977). Size specific fecundity is inversely related to latitude (Hay 1985).

Growth and Development

Egg Size: Unfertilized egg is 1.0 mm in diameter (Outram 1955); 1.2-1.5 mm in diameter after fertilization (Hart 1973).

Embryonic Development: Hatching occurs in 11-12 days at 10.7°C, 14-15 days at 8.5°C, and 28-40 days at 4.4°C (Outram 1955). Most eggs hatch at night (Alderdice and Velsen 1971).

Larval Size: 5 to about 26 mm total length (TL). Metamorphosis to juvenile begins at about 26 mm TL and is completed by 35 mm (Fraser 1922, Stevenson 1962).

Juvenile Size: 35 to 150 mm TL depending on region. Growth of juveniles is dependent on population size and environmental factors (Reilly 1988).

Age and Size of Adults: From 13 to 26 cm TL depending on region. Herring mature at 2-3 years in California and 3-4 years in Washington. Herring live up to 19 years and grow to a maximum length of 50 cm TL (Morrow 1980). Northern stocks live longer than southern stocks (Wang 1986; Grosse and Hay 1989).

Food and Feeding

Trophic Mode: Selective pelagic plankton feeder, although filter feeding has been observed.

Food items: Larvae consume diatoms, tintinnids, invertebrate and fish eggs, crustacean larvae, mollusc larvae, and copepods. Juveniles eat primarily crustaceans: copepods, cladocerans, euphausiids,

mysids, amphipods, and decapod larvae. They also consume molluscs and fish larvae. Adults eat planktonic crustaceans: copepods, euphausiids, and amphipods; and fish larvae (Hart 1973; Simenstad et al. 1979; Miller et al. 1980; McCabe et al. 1983).

Biological Interactions

Predation: Eggs are eaten by many species of fishes, ducks, and gulls, while larvae are prey for ctenophores, jellyfish, amphipods, chaetognaths, clupeoid fishes, and salmonids. Juveniles and adults are consumed by squid, sharks, salmon, cods, sculpins, lingcod (*Ophiodon elongatus*), sand sole (*Psettichthys melanostictus*), and other fishes. They are also eaten by many species of birds and marine mammals such as seals and sperm whales (*Physeter catodon*) (Hart 1973; Simenstad et al. 1979; Grosse and Hay 1989).

Factors Influencing Populations: There is no relation between number of eggs spawned and number of recruits to adult population (Pacific Fishery Management Council 1981). Egg and larva mortalities are thought to be the major component affecting population sizes. Substantial natural mortalities of both eggs and larvae occur during their development by tidal fluctuations, desiccation, freezing, low oxygen, wave action, and predation. Approximately 98-99% of all larvae are killed by predation, competition, and offshore transport. Many hypotheses have been developed to describe which factors determine year-class abundance. In general, clupeoid year-class strength appears to be determined within its first six months (Smith 1985). Other studies indicate that onshore transport, density-dependent mechanisms, upwelling, sea temperatures, predation, climate fluctuations, initial feeding period of larvae, and larval dispersal patterns may be important in determining population abundances (Lasker 1985; Grosse and Hay 1989). Juveniles and adults are affected by competition, predation, disease, spawning stress, and fishing. Human and natural alterations of water quality, spawning substrate and habitat , food supplies, and migration rates can also affect populations (Alaska Dept. Fish Game 1985).

References Cited

Alaska Dept. Fish Game. 1985. Alaska habitat management guide. South central region, Vol. 1: life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, 429 pp.

Alderdice, D. F., and A. S. Hourston. 1985. Factors influencing development and survival of Pacific herring (*Clupea harengus pallasi*) eggs and larvae to beginning of exogenous feeding. Can. J. Fish. Aquat. Sci. 42 (Suppl. 1): 56-68.

Alderdice, D. F., and F. P. J. Velsen. 1971. Some effects of salinity and temperature on early development of Pacific herring (*Clupea pallasi*). J. Fish. Res. Board Can. 28(10): 1545-1562.

Barnhart, R. A. 1988. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest) — Pacific herring. U.S. Fish Wildl. Serv. Biol. Rept. 82(11.79). U.S. Army Corps Eng., TR EL-82-4. 14 pp.

Boehlert, G. W., and J. B. Morgan. 1985. Turbidity enhances feeding abilities of larval Pacific herring, *Clupea harengus pallasi*. Hydrobiol. 123(2): 161-170.

Eldridge, M. B., and W. M. Kaill. 1973. San Francisco Bay area's herring resource - a colorful past and a controversial future. Mar. Fish. Rev. 25: 25-31.

Fraser, C. M. 1922. The Pacific herring. Biol. Board Can., Contrib. Can. Biol. Fish. 1921(6): 103-111.

Garrison, K. J. and B. S. Miller. 1982. Review of the early life history of Puget Sound fishes. Fish. Res. Inst., Univ. Wash., Seattle, FRI-UW-8216, 729 pp.

Grosse, D. J., and D. E. Hay. 1989. Pacific herring, *Clupea harengus pallasi*, in the Northeast Pacific and Bering Sea. *In* N. J. Wilimovsky, L. S. Incze, and S. J. Westerheim (editors), Species synopses, life histories of selected fish and shellfish of the Northeast Pacific and Bering Sea, pp. 34-54. Wash. Sea Grant Prog. and Fish. Res. Inst., Univ. Wash., Seattle.

Haegele, C. W., and J. F. Schweigert. 1985. Distribution and characteristics of herring spawning grounds and description of spawning behavior. Can. J. Fish. Aquat. Sci. 42(Suppl. 1): 39-55.

Hardwick, J. E. 1973. Biomass estimates of spawning herring, *Clupea harengus pallasi*, herring eggs, and associated vegetation in Tomales Bay. Calif. Fish Game 59(1): 36-61.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Board Can., Bull. 180, 740 pp.

Hay, D. E. 1985. Reproductive biology of Pacific herring (*Clupea harengus pallasi*). Can. J. Fish. Aquat. Sci. 42(Suppl. 1): 111-126.

Lasker, R. 1985. What limits clupeoid production? Can. J. Fish. Aquat. Sci., 42(Suppl. 1): 31-38.

McCabe, G. T. Jr., W. D. Muir, R. L. Emmett, and J. T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River estuary. Fish. Bull., U.S. 81(4): 815-826.

Miller, B. S., C. A. Simenstad, J. N. Cross, K. L. Fresh, and S. N. Steinfort. 1980. Nearshore fish and macroinvertebrate assemblages along the Strait of Juan de Fuca including food habits of the common nearshore fish. Interagency (NOAA, EPA) Energy/ Environ. Res. Dev. Prog. Rep., EPA-600/7-80-027, 211 pp.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Alaska Northw. Publ. Co., Anchorage, 248 pp.

Nelson-Smith, A. 1973. Oil pollution and marine ecology. Plenum Press, New York, 260 pp.

Outram, D. N. 1955. The development of the Pacific herring egg and its use in estimating age of spawn. Fish. Res. Board Can., Pac. Biol. Sta. Circ. 40, 9 pp.

Pacific Fishery Management Council. 1981. Pacific herring fishery management plan. Pac. Fish. Manag. Council, Portland, OR, 127 pp.

Rabin, D. J., and R. A. Barnhart. 1977. Fecundity of Pacific herring, *Clupea harengus pallasi*, in Humboldt Bay. Calif. Fish Game 63(3): 193-196.

Reilly, P. N. 1988. Growth of young-of-the-year and juvenile Pacific herring from San Francisco Bay, California. Calif. Fish Game 74(1): 38-48.

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, Robert N. Lea, and W. B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. Amer. Fish. Soc., Spec. Publ., No. 12, 174 pp.

Simenstad, C. A., B. S. Miller, C. F. Nyblad, K. Thornburgh, and L. J. Bledsoe. 1979. Food web relationships of northern Puget Sound and the Strait of Juan de Fuca. U.S. Interagency (NOAA/EPA) Energy/Environ. Res. Dev. Prog. Rep., EPA-600/7-79-259, Wash., D.C., 335 pp.

Smith, P. E. 1985. Year-class strength and survival of 0-group clupeoids. Can. J. Fish. Aquat. Sci. 42(Suppl. 1): 69-82.

Spratt, J. D. 1981. Status of the Pacific herring, *Clupea harengus pallasi*, in California to 1980. Calif. Fish Game, Fish. Bull. 171: 1-104.

Stevenson, J. C. 1962. Distribution and survival of herring larvae (*Clupea pallasi* Valenciennes) in British Columbia waters. J. Fish. Res. Board Can. 19(5): 735-810.

Suer, A. L. 1987. The herring of San Francisco and Tomales Bays. The Ocean Res. Inst., San Francisco, CA. 64 pp.

Thompson, B. G. (Chief). 1986. Fisheries of the United States, 1985. Current fishery statistics no. 8368. U.S. Dept. Comm., NOAA, Nat.. Mar. Fish. Serv., Nat Fish. Stat. Prog. (F/S21), Wash., D.C., 222 pp.

Trumble, R. J. 1983. Management plan for baitfish species in Washington State. Prog. Rept. No. 195, Wash. Dept. Fish., Olympia, 106 pp.

Wang, J. C. S. 1986. Fishes of the Sacramento-San Joaquin estuary and adjacent waters, California: A guide to the early life histories. Tech. Rept. 9. Interagency ecological study program for the Sacramento-San Joaquin estuary. Calif. Dept. Water Res., Calif. Dept. Fish Game, U.S. Bureau Reclam., and U.S. Fish Wildl. Serv., various pagination.

Pacific herring
Clupea pallasi

Grays Harbor
Washington
Reviewer: C. A. Simenstad

Salinity Zone	Life Stage	Relative Abundance by Month J F M A M J J A S O N D	R
Tidal Fresh 0.0 - 0.5 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		1
	Eggs		1
Mixing 0.5 - 25.0 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		2
	Eggs		1
Seawater >25.0 ppt	Adults		1
	Spawning		1
	Juveniles		1
	Larvae		2
	Eggs		1

Comments: No official documentation of spawning, but it is possible.

Legend:

Relative Abundance:

= Not Present
..... = No Data
= Rare
= Common
= Abundant
= Highly Abundant

Data Reliability (R):

1 = Highly Certain
2 = Moderately Certain
3 = Reasonable Inference

Appendix 3. Table of References and Personal Communications

Common/Scientific Name	Skagit Bay	Hood Canal	Puget Sound
Blue mussel *Mytilus edulis*	71, 194, 266, 360, 361, AJ, BX	266, 360, 361, 453, AJ, BX	71, 201, 266, 360, 361, AJ, BX
Pacific oyster *Crassostrea gigas*	71, 266, AJ, BX	71, 266, 295, 316, AJ, BX	71, 266, 316, AJ, AQ, BX
Horseneck or gaper clam *Tresus capax*	43, 266, 317, AJ, BX	43, 266, 317, AJ, BX	43, 266, 317, AJ, BX
Pacific gaper *Tresus nuttali*	71, 317, AJ, BX	71, 317, AJ, BX	71, 317, AJ, BX
California jacknife clam *Tagelus californianus*	not found 168, 215	not found 168, 215	not found 168, 215
Pacific littleneck clam *Protothaca staminea*	71, 194, 355, AJ, BX	71, 355, 453, AJ, BX	71, AJ, BX
Manila (Japanese) clam *Venerupis japonica*	71, 73, 194, AJ, BX	71, 73, 163, 184, 288, 453, AJ, BX	73, 288, 332, AJ, BX
Eastern softshell clam *Mya arenaria*	162, 266, 291, 310, AJ, BX	310, 453, AJ, BX	266, 291, 310, AJ, BX, Y
Geoduck *Panope abrupta*	11, 160, 161, AJ, BX	11, 160, 161, AJ, BX	11, 160, 161, AJ, BX
Bay shrimp *Crangon franciscorum*	246, 219	453, E	71, 219, Y
Dungeness crab *Cancer magister*	100, 246, Y	453, E, Y	101, Y
Leopard shark *Triakis semifasciata*	not found 95, 264	not found 95, 264	not found 95, 264
White sturgeon *Acipenser transmontanus*	rare 95, 260	not found 95, 260	not found 95, 260
Green sturgeon *Acipenser medirostris*	not found 95, 260	not found 95, 260	rare 95, 260
American shad *Alosa sapidissima*	260, 141	rare 260	rare 260
Pacific herring *Clupea pallasi*	412, 159, 266, 37, AD, BQ	158, 159, 266, 412, 453, BQ	133, 134, 158, 159, 266, 412, AD, BQ
Northern anchovy *Engraulis mordax*	37, 260, 141, AD, BQ	260, AD, BQ, BZ	37, 260, AD, BQ
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	202, AS	202, 453, AS	202, AS
Pink salmon *Oncorhynchus gorbuscha*	397, 359, 287, AD, BO, BZ	287, 338, 448, 453, AD, BZ	287, 359, 448, AD, BZ
Chum salmon *Oncorhynchus keta*	84, 287, 396, AD, BO, BZ	287, 338, 359, 448, 453, AD, BZ	124, 134, 287, 359, 448, AD, BZ
Coho salmon *Oncorhynchus kisutch*	287, 397 ,436, 448, AD, BO	338, 448, 453, AD, BZ	133, 134, 287, 359, 448, AD
Steelhead *Oncorhynchus mykiss*	136, 260, 296, 297, AD, AE, BZ	136, 260, 350, 453, AD, AE, BZ	136, 260, 297, AD, AE, BZ
Sockeye salmon *Oncorhynchus nerka*	rare 448	rare 448	287, 448, AD, BZ
Chinook salmon *Oncorhynchus tshawytscha*	84, 397, 448, AD, BO, BZ	287, 359, 448, 453, AD, BZ	134, 287, 359, 396, 448, AD, BZ
Surf smelt *Hypomesus pretiosus*	266, 303, 397, 412, BQ	266, 303, 412, BQ	266, 303, 412, BQ
Longfin smelt *Spirinchus thaleichthys*	37, 397, AD, BQ, BZ	not found 95, BQ	37, 104, 260, 261, BQ, BZ
Eulachon *Thaleichthys pacificus*	rare 260, BQ	not found 260, BQ	rare 260, 452
Pacific tomcod *Microgadus proximus*	37, 397, 433, 438	260, 301, 433, 438	95, 103, 134, 260, 433, 438, CK
Topsmelt *Atherinops affinis*	not found 95, 260	not found 95, 260	not found 95, 260
Jacksmelt *Atherinopsis californiensis*	not found 95, 260	not found 95, 260	not found 95, 260
Threespine stickleback *Gasterosteus aculeatus*	95, 260, 397, 417, 427, BO	95, 260, 427, 453	95, 133, 260, 262, 427, 452, AD, BZ
Striped bass *Morone saxatilis*	rare 95	not found 95, 260	not found 95, 260
Kelp bass *Paralabrax clathratus*	not found 95, 260	not found 95, 260	not found 95, 260
Barred sand bass *Paralabrax nebulifer*	not found 95, 260	not found 95, 260	not found 95, 260
White seabass *Atractoscion (=Cynoscion) nobilis*	rare 95	not found 95	not found 95
White croaker *Genyonemus lineatus*	not found 95, 260	not found 95	not found 95
Shiner perch *Cymatogaster aggregata*	85,141,260,397,BO	95, 141, 260, 453	95, 103, 134, 141, 260, 262, 438, 446
Arrow goby *Clevlandia ios*	37,95, 141, 260	37, 95, 141, 260, 453	37, 65, 95, 141, 260, 431
Pacific sand lance *Ammodytes hexapterus*	37, 260, AD, BQ	453, AD, BQ	37, 133, 134, 260, 411, 431, AD, BQ
Lingcod *Ophiodon elongatus*	24, 51, 224, 260, AP	24, 51, 224, AP, BZ	24, 51, 224, AP, BZ
Pacific staghorn sculpin *Leptocottus armatus*	37, 85, 397, AD, BZ	37, 438, 453, AD, BZ	37, 103, 134, AD, BZ
California halibut *Paralichthys californicus*	not found 95, 260	not found 95, 260	not found 95, 260
Diamond turbot *Hypsopsetta guttulata*	not found 95, 260	not found 95, 260	not found 95, 260
English sole *Pleuronectes vetulus*	37, 396, 397	37, 141, 300	37, 134, 141, 260, 300, 426, 431
Starry flounder *Platichthys stellatus*	37, 85, 397, BO	37, 300, 431, 438, 453	37, 134, 431, 438, AD, BZ
	Skagit Bay	Hood Canal	Puget Sound

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Grays Harbor	Willapa Bay	Columbia River
Blue mussel *Mytilus edulis*	CI	CI	AA
Pacific oyster *Crassostrea gigas*	266, 437, CI	266, 423, 437, CI	not found AA
Horseneck or gaper clam *Tresus capax*	54, 172, 368, CI	54, 172, 368, CI	not found AA
Pacific gaper *Tresus nuttali*	rare CI	rare CI	not found AA
California jacknife clam *Tagelus californianus*	not found 368, CI	not found 368, CI	not found AA
Pacific littleneck clam *Protothaca staminea*	71, 368, CI	368, CI	not found AA
Manila (Japanese) clam *Venerupis japonica*	71, 73, 368, CI	73, 368, CI	not found AA
Eastern softshell clam *Mya arenaria*	96, 310, 368, CI	310, 423, CI	310 AA
Geoduck *Panope abrupta*	not found CI	not found CI	not found AA
Bay shrimp *Crangon franciscorum*	181, 219, C	181, 219, C	108, 219, 447
Dungeness crab *Cancer magister*	18, 389, C	18, C	248, BD
Leopard shark *Triakis semifasciata*	not found 264	not found 264	not found BD
White sturgeon *Acipenser transmontanus*	AZ 96	96, 398, AZ	398, AT, AZ, BD
Green sturgeon *Acipenser medirostris*	96, AZ, M	96, AZ, M	294, AT, AZ, BD
American shad *Alosa sapidissima*	96, 358, BZ, M	96, 358, BZ	40, 118, 171, 279, 294, 403
Pacific herring *Clupea pallasi*	269, 358, AD, BZ	266, 269, 358, AD, BZ	40, 132, 251, 269, 279, BD
Northern anchovy *Engraulis mordax*	269, 358, BZ	204, 269, BZ	40, 132, 169, 204, 269, 279, BD
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	96	420, 423	234, 279, BB
Pink salmon *Oncorhynchus gorbuscha*	rare 308, AD	rare 308	rare AF
Chum salmon *Oncorhynchus keta*	96, 308, 312, 366, AD, BZ, M	308, 420, 437, M	40, 72, 92, BD
Coho salmon *Oncorhynchus kisutch*	96, 308, 358, 366, AD, BZ, M	308, 420, 437, AD, M	40, 92, 107, 251, 279, BD
Steelhead *Oncorhynchus mykiss*	96, 358, AD, BZ	177, 420, AD	40, 92, 279, 294, AF, BD
Sockeye salmon *Oncorhynchus nerka*	not found 308	not found 308	40, 92, 118, 279, Y
Chinook salmon *Oncorhynchus tshawytscha*	96, 308, 358, 359, 366, AD, BZ, M	308, 437, AD, M	40, 92, 139, 248, 251, 279, AF, BD, Y
Surf smelt *Hypomesus pretiosus*	96, 358, BC, BZ	96, 358, BZ	40, 269, 279, BD
Longfin smelt *Spirinchus thaleichthys*	104, 180, 269, 340, 358, 366, AD, BZ	180, 269, 358, 423	40, 169, 269, 279, BD
Eulachon *Thaleichthys pacificus*	96, M	M	118, 269, BG
Pacific tomcod *Microgadus proximus*	96, 180, 269, 330, 366, M	96, 180, 269, 330, 366,	40, 269, 279, 330, BD
Topsmelt *Atherinops affinis*	not found 96, 358, 366	not found 177	rare 247
Jacksmelt *Atherinopsis californiensis*	not found 119	not found 119	not found 119
Threespine stickleback *Gasterosteus aculeatus*	96, 366, 427	96, 366, 427	40, 249, 279, 427, BD
Striped bass *Morone saxatilis*	not found 96, 358, 366	not found 177	not found BD
Kelp bass *Paralabrax clathratus*	not found 264	not found 264	not found BD
Barred sand bass *Paralabrax nebulifer*	not found 264	not found 264	not found BD
White seabass *Atractoscion (=Cynoscion) nobilis*	not found 96, 366	not found 77, 96, 366	not found BD
White croaker *Genyonemus lineatus*	not found 96, 366	not found 77, 96, 366	not found BD
Shiner perch *Cymatogaster aggregata*	96, 340, 366, 446, M	96, 340, 366, 446	40, 279, 446, BD
Arrow goby *Clevlandia ios*	65, 96, 366, 437	65, 177, 366, 437	rare BD
Pacific sand lance *Ammodytes hexapterus*	269, 358, BZ	269, 358, BZ	40, 269, 279, BD
Lingcod *Ophiodon elongatus*	19, 82, 93, 269	19, 82, 93, 269	rare 279, AA
Pacific staghorn sculpin *Leptocottus armatus*	19, 96, 269, 366, BZ, M	19, 96, 269, 366, BZ	40, 203, 269, 279, BD
California halibut *Paralichthys californicus*	not found 96, 366	not found 77, 96, 366	not found BD
Diamond turbot *Hypsopsetta guttulata*	not found 96, 366	not found 77, 96, 366	not found BD
English sole *Pleuronectes vetulus*	252, 269, 334	252, 269, 334	40, 269, 279, BD
Starry flounder *Platichthys stellatus*	19, 96, 269, 366, M, U	19, 96, 269, 366	40, 204, 269, 279, BD
	Grays Harbor	Willapa Bay	Columbia River

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Nehalem Bay	Tillamook Bay	Netarts Bay
Blue mussel *Mytilus edulis*	AI 360	71, 148, 201, 360, 361, AI	71, 150, 201, 217, 360, 361, 399, AI
Pacific oyster *Crassostrea gigas*	not found 239, AI	56, 63, 71, 239, 316, AI	56, 63, 71, 217, 239, 316, 399, AI
Horseneck or gaper clam *Tresus capax*	rare 146, AI	131, 148, 172, 332, AI	150, 172, 217, 332, 399, AI
Pacific gaper *Tresus nuttali*	not found 172, 245, AI	rare 131, 148, 172, AI	71, 217, 317, 399, AI
California jacknife clam *Tagelus californianus*	not found AI	not found 0	not found AI
Pacific littleneck clam *Protothaca staminea*	146, 172, 245, 332, AI	131, 172, 245, 332, AI	150, 172, 217, 245, 332, 399, AI
Manila (Japanese) clam *Venerupis japonica*	not found 146, 172, 245, AI	73, 131, 172, 245, 332, AI	150, 172, 217, 245, 332, 399, AI
Eastern softshell clam *Mya arenaria*	146, 172, 245, 310, AI	148, 172, 245, 310, AI	150, 172, 217, 245, 310, 399, AI
Geoduck *Panope abrupta*	not found 172, 245, AI	not found 172, 245	rare 172, 245, AI
Bay shrimp *Crangon franciscorum*	175, 181, 219, 447	175, 181, 219, 447, AI	175, 181, 219, 447, P
Dungeness crab *Cancer magister*	146, AI	148, AI	150, 217, 399, AI, Q
Leopard shark *Triakis semifasciata*	not found AV	not found 39, 131	not found Q
White sturgeon *Acipenser transmontanus*	AV, BD	rare 39, 131	not found Q
Green sturgeon *Acipenser medirostris*	rare AV	rare 39, 131	not found Q
American shad *Alosa sapidissima*	rare 39, 131, 146, AV	rare 39, 131, 148	rare 217, 399, Q
Pacific herring *Clupea pallasi*	39, 131, 146, 298, AV, N	39, 90, 131, 298, N	150, 217, 298, 399, N, Q
Northern anchovy *Engraulis mordax*	131, 269, 298, AV	39, 131, 269, 298	217, 399, Q
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	39, 131, 146, 154, 227, 402, AV	39, 131, 148, 154, 155, 402	154, 155, 217, 399, 402, Q
Pink salmon *Oncorhynchus gorbuscha*	not found AV	not found 39, 131	not found 217, 399, Q
Chum salmon *Oncorhynchus keta*	146, 227, AV	39, 131, 290, 422, K	76, 399, BH, Q
Coho salmon *Oncorhynchus kisutch*	146, 227, 430, AV	39, 131, 148, 422, 430, K	150, 217, 227, Q
Steelhead *Oncorhynchus mykiss*	227, AV	39, 131, 227, 422	rare 227, 399, Q
Sockeye salmon *Oncorhynchus nerka*	not found AV	not found 39, 131, K	not found Q
Chinook salmon *Oncorhynchus tshawytscha*	280, AV	39, 131, 280, 430, K	rare Q
Surf smelt *Hypomesus pretiosus*	39, 131, 269, 298	39, 131, 269, 298	269, 298, 399, Q
Longfin smelt *Spirinchus thaleichthys*	rare AV	rare 39, 131	not found 399, Q
Eulachon *Thaleichthys pacificus*	not found 0	not found 39, 131	not found 399, Q
Pacific tomcod *Microgadus proximus*	39, 131	39, 131, 148, 269, 298	269, 298, 399, Q
Topsmelt *Atherinops affinis*	rare AV	39, 131	150, 217, 399, Q
Jacksmelt *Atherinopsis californiensis*	not found 119	not found 39, 131	not found 217, 399, Q
Threespine stickleback *Gasterosteus aculeatus*	39, 131, 427	39, 131, 427	399, 427, Q
Striped bass *Morone saxatilis*	not found AV	not found 39, 131	not found 217, 399, Q
Kelp bass *Paralabrax clathratus*	not found 146	not found 39, 131	not found 217, 399, Q
Barred sand bass *Paralabrax nebulifer*	not found 146	not found 39, 131	not found 217, 399, Q
White seabass *Atractoscion (=Cynoscion) nobilis*	not found 146	not found 39, 131	not found 217, 399, Q
White croaker *Genyonemus lineatus*	not found 146	not found 39, 131	not found 217, 399, Q
Shiner perch *Cymatogaster aggregata*	146, 446	39, 131, 148, 446	399, 446, Q
Arrow goby *Clevlandia ios*	not found	rare 39, 131	not found 217, 399, Q
Pacific sand lance *Ammodytes hexapterus*	39, 131, 269, 298, 330	39, 131, 269, 298, 330	269, 298, 330, 399, Q
Lingcod *Ophiodon elongatus*	not found 146	39, 131, 148	150, 217, 399, Q
Pacific staghorn sculpin *Leptocottus armatus*	39, 131, 146, 203, 269	39, 131, 148, 203, 269	116, 203, 269, 298, 399, Q
California halibut *Paralichthys californicus*	not found 146	not found 39, 131	not found Q
Diamond turbot *Hypsopsetta guttulata*	not found 119	not found 39, 131	not found 119
English sole *Pleuronectes vetulus*	39, 131, 298	39, 131, 298	217, 298, 399, Q
Starry flounder *Platichthys stellatus*	39, 131, 146, 204, 298	39, 131, 148, 204, 298	150, 298, 399, Q
	Nehalem Bay	Tillamook Bay	Netarts Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.
Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Siletz River	Yaquina Bay	Alsea River
Blue mussel *Mytilus edulis*	rare 147, 384, AI	71, 152, 201, 360, 361, AI	rare 143, AI
Pacific oyster *Crassostrea gigas*	not found 384, AI	56, 63, 71, 239, 316, 421, AI	not found 419, AI
Horseneck or gaper clam *Tresus capax*	not found 147, 384, AII	44, 152, 172, 332, AI	172, 332, AI
Pacific gaper *Tresus nuttali*	not found 147, 384, AI	rare 152, 172, AI	not found 143, 172, AI
California jacknife clam *Tagelus californianus*	not found AI	not found AI	not found AI
Pacific littleneck clam *Protothaca staminea*	not found 147, 172, 245, 332, AI	74, 172, 238, 245, 332, AI	rare 143, 172, 245, 332, AI
Manila (Japanese) clam *Venerupis japonica*	not found 335, AI	rare 172, AI	not found 172, AI
Eastern softshell clam *Mya arenaria*	rare 147, 172, 245, AI	152, 172, 245, 310, AI	143, 172, 245, 310, AI
Geoduck *Panope abrupta*	not found 245, 384, AI	not found 172, 245, AI	not found 172, 245, AI
Bay shrimp *Crangon franciscorum*	175, 181, 219, 447	218, 219, W	175, 218, 219
Dungeness crab *Cancer magister*	147, 336, 384, AI	30, C3, 152, W, AI	143, 336, 419, AI
Leopard shark *Triakis semifasciata*	not found CE	not found 31, 32, 278, N, W, CE	not found CE
White sturgeon *Acipenser transmontanus*	rare N, CE	152, N, AO	rare N, CE
Green sturgeon *Acipenser medirostris*	rare 384, CE	rare 152, W, AO	rare N, CE
American shad *Alosa sapidissima*	rare 147, 384, CE	152, 278, N, CE	143 N, CE
Pacific herring *Clupea pallasi*	147, 384, N, CE	30, 31, 278, 298, 385, N	143, 298, N, CE
Northern anchovy *Engraulis mordax*	384, N, CE	30, 31, 32, 278, 298, N, CE	143, N, CE
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	147, 154, 155, 384, 402, CE	152, 154, 155, 278, 421, CE	154, 155, CE
Pink salmon *Oncorhynchus gorbuscha*	rare CE	rare 30, 31, 278, CE	rare CE
Chum salmon *Oncorhynchus keta*	20, 364, 384, G, CE	20, 278, 364, CE	20, 364, 419, CE
Coho salmon *Oncorhynchus kisutch*	147, 364, 384, 430, CE	152, 278, 364, 421, 430, CE	364, 419, 430, CE
Steelhead *Oncorhynchus mykiss*	364, 384, CE	278, 364, 421, CE	13, 68, 364, CE
Sockeye salmon *Oncorhynchus nerka*	rare CE	not found 278, CE	not found CE
Chinook salmon *Oncorhynchus tshawytscha*	147, 280, 364, 384, 430, CE	278, 280, 364, 430, CE	280, 430, CE
Surf smelt *Hypomesus pretiosus*	147, 269, 298, 384, CE	30, 31, 278, 298, CE	278, 298, N
Longfin smelt *Spirinchus thaleichthys*	not found 384, CE	278, 298, W, CE	rare N, CE
Eulachon *Thaleichthys pacificus*	not found 384, CE	not found N, W, CE	not found N, CE
Pacific tomcod *Microgadus proximus*	147, 269, 298, 384, CE	32, 152, 298, 330, W, CE	143, 298, N, CE
Topsmelt *Atherinops affinis*	not found 384, CE	30, 31, 278, 298, 347, W, CE	278, 347, N, CE
Jacksmelt *Atherinopsis californiensis*	not found 147, 384, CE	rare 32, 33	not found 143, CE
Threespine stickleback *Gasterosteus aculeatus*	384, 427, CE	30, 31, 278, 427, W, CE	30, 31, 278, 427
Striped bass *Morone saxatilis*	rare 384, CE	rare N, CE	not found 143, CE
Kelp bass *Paralabrax clathratus*	not found 384, CE	not found 30, 31, 278, 298, W, CE	not found 143, CE
Barred sand bass *Paralabrax nebulifer*	not found 384, CE	not found 30, 31, 278, 298, CE, W	not found 143, CE
White seabass *Atractoscion (=Cynoscion) nobilis*	not found 384, CE	not found 30, 31, 278, 298, W, CE	not found 143, CE
White croaker *Genyonemus lineatus*	not found 384, CE	not found 30, 31, 32, 278, 298, W, CE	not found 143, CE
Shiner perch *Cymatogaster aggregata*	147, 384, 446, N, CE	30, 31, 278, 446, 449, CE, W	30, 31, 143, 446, CE
Arrow goby *Clevlandia ios*	not found 384, CE	278, W	not found N, CE
Pacific sand lance *Ammodytes hexapterus*	147, 269, 298, 330, 384	278, 298, 330, N	298, 330, N
Lingcod *Ophiodon elongatus*	not found 384, CE	32, 152, 278, 298, W, CE	rare N, CE
Pacific staghorn sculpin *Leptocottus armatus*	147, 203, 384, CE	30, 31, 32, 152, 278, 298, N, W, CE	30, 31, 143, 203, 278, 298, N, CE
California halibut *Paralichthys californicus*	not found 384	not found 30, 31, 32, W	not found 143, CE
Diamond turbot *Hypsopsetta guttulata*	not found 119	not found 119	not found 119
English sole *Pleuronectes vetulus*	384, 442, CE	31, 32, 32, 38, 298, 335, 442, N, W, CE	30, 31, 32, 38, 298, 335, 442, N, W, CE
Starry flounder *Platichthys stellatus*	39, 131, 147, 384, CE	30, 31, 32, 152, 278, 298, N, W, CE	143, 298, CE

Siletz River Yaquina Bay Alsea River

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Siuslaw River	Umpqua River	Coos Bay
Blue mussel *Mytilus edulis*	71, 151, 201, 360, 361, 418, AI, BE	AI 323	71, 145, 201, 337, 360, 361, AI
Pacific oyster *Crassostrea gigas*	not found 418, AI, BE	323, AI, AR	56, 63, 71, 239, 316, 429, AI
Horseneck or gaper clam *Tresus capax*	151, 172, 245, 332, 418, AI, BE	rare 323, AI	44, 145, 172, 332, 337, 429, AI
Pacific gaper *Tresus nuttali*	not found 151, 172, AI	not found 149, 323, AI	rare 145, 172, 337, 429, AI
California jacknife clam *Tagelus californianus*	not found AI	not found AI	not found AI
Pacific littleneck clam *Protothaca staminea*	rare 151, 172, 245, 332, 418, AI	not found 149, 172, 245, AI	74, 145, 172, 245, 332, 337, AI
Manila (Japanese) clam *Venerupis japonica*	not found 151, 172, 418, AI	not found 149, 172, 245, 323, AI	145, 172, 184, 332, 429, AJ
Eastern softshell clam *Mya arenaria*	151, 172, 245, 310, AI, BE	149, 172, 245, 310, 323, AI, AR	145, 172, 245, 310, 429, AI
Geoduck *Panope abrupta*	not found 172, 245, AI	not found 172, 245, AI	not found 172, 245, 337, 429, AI
Bay shrimp *Crangon franciscorum*	175, 197, 218, 219	175, 218, 219, AR	41, 175, 218, 219, 337, H
Dungeness crab *Cancer magister*	151, 197, 336, AI, BE	149, 323, 336, AI, AR	145, 336, 337, 429, AI, BJ
Leopard shark *Triakis semifasciata*	not found BE	not found AR	not found 337, BJ
White sturgeon *Acipenser transmontanus*	rare BE	AR	91, 337, BJ
Green sturgeon *Acipenser medirostris*	rare BE	127, 149, 200, 228, 277, AR	91, 145, 337, BJ, H
American shad *Alosa sapidissima*	151, 197, 364, BE	127, 200, 228, 364, 418, AR	91, 193, 277, 337, 429, BJ
Pacific herring *Clupea pallasi*	151, 197, 298, BE	149, 200, 277, 298, 323, AR, N	91, 145, 193, 277, 298, 337, 429, N, BJ
Northern anchovy *Engraulis mordax*	197, BE	42, 200, 277, AR, N	91, 298, 337, N, BJ
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	53, 154, 155, 197, BE	149, 200, 277, 154, 155, AR	145, 154, 155, 337, 429, AB, BJ
Pink salmon *Oncorhynchus gorbuscha*	not found 151, 197, BE	not found 277, 323, AR	rare 91, 337, BJ
Chum salmon *Oncorhynchus keta*	20, 197, 364, 418, BE	rare 20, 228, 277, AR	193, 429, AB, BJ, H
Coho salmon *Oncorhynchus kisutch*	151, 197, 364, 430, BE	127, 200, 228, 277, 323, 430, AR	91, 193, 337, 429, 430, AB, BJ
Steelhead *Oncorhynchus mykiss*	68, 197, 418, BE	127, 200, 228, 323, AR	91, 193, 337, 429, BJ
Sockeye salmon *Oncorhynchus nerka*	not found BE	not found AR	not found BJ
Chinook salmon *Oncorhynchus tshawytscha*	197, 280, 364, 430, BE	200, 228, 277, 280, 323, 418, 430, AR	91, 193, 280, 337, 429, 430, AB, BJ
Surf smelt *Hypomesus pretiosus*	197, 298, BE	200, 277, S98, 323, AR	91, 193, 298, 337, H, AB, BJ
Longfin smelt *Spirinchus thaleichthys*	rare 197, BE	rare 200, 277, AR	91, 193, 337, AB, BJ
Eulachon *Thaleichthys pacificus*	rare 197, BE	200, 277, 323, AR	rare 91, 193, 337, 429, BJ
Pacific tomcod *Microgadus proximus*	151, 197, BE	149, 200, 323, 330, AR	145, 330, H, BJ
Topsmelt *Atherinops affinis*	151, 197, 278, 347, BE	200, 277, 323, 347, AR	41, 91, 193, 337, 347, 429, H, AB, BJ
Jacksmelt *Atherinopsis californiensis*	not found 151, 197, BE	not found 149, 200, 277, AR	91, 145, 193, AB, BJ
Threespine stickleback *Gasterosteus aculeatus*	197, 427, BE	200, 277, 427, AR	91, 193, 427, AB, BJ
Striped bass *Morone saxatilis*	197, 253, 276, BE	127, 200, 228, 253, 276, 277, 323, AR	91, 193, 253, 276, 277, 337, 407, 409, 429 BJ
Kelp bass *Paralabrax clathratus*	not found 151, 197	not found 149, 200, 277, 323	not found 91, 193, 337, BJ
Barred sand bass *Paralabrax nebulifer*	not found 151, 197	not found 149, 200, 277, 323	not found 91, 193, 337, BJ
White seabass *Atractoscion (=Cynoscion) nobilis*	not found 151, 197	not found 149, 200, 277, 323	rare 91, 193, 337, BJ
White croaker *Genyonemus lineatus*	not found 151, 197	not found 149, 200, 277, 323	rare 91, 193, 337, BJ
Shiner perch *Cymatogaster aggregata*	151, 197, 446, BE	42, 200, 277, 446, AR	41, 91, 193, 337, H, AB, BJ
Arrow goby *Clevlandia ios*	rare 197, BE	rare 200, 277, 323, AR	91, 116, 182, 193, 337, H, AB
Pacific sand lance *Ammodytes hexapterus*	197, 298, 330, BE	42, 200, 277, 298, 330, AR	91, 193, 298, 330, 337, H, AB, BJ
Lingcod *Ophiodon elongatus*	rare 197, 151, BE	116, 149, 200, 298, 323, AR	91, 145, 193, 337, AB, BJ, H
Pacific staghorn sculpin *Leptocottus armatus*	151, 197, 203, 298, BE	42, 200, 203, 277, 298, AR	91, 145, 193, 203, 337, H, AB, BJ
California halibut *Paralichthys californicus*	not found 197	not found 200	not found 337
Diamond turbot *Hypsopsetta guttulata*	not found 119	not found 119	not found 119
English sole *Pleuronectes vetulus*	38, 197, 335, 442, BE	38, 42, 200, 277, 323, 335, 442, AR	38, 91, 193, 335, 337, 442, H, AB, BJ
Starry flounder *Platichthys stellatus*	151, 197, 298, BE	42, 149, 200, 277, 298, 323, AR	91, 145, 193, 298, 337, 429, AB, BJ
	Siuslaw River	Umpqua River	Coos Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Rogue River	Klamath River	Humboldt Bay
Blue mussel *Mytilus edulis*	rare AI, BW	not found AU, BS, CJ	351 86
Pacific oyster *Crassostrea gigas*	not found AI, BW	not found AU, BS, CJ	27, 56, 71, 316, 351, 375, 428, X, CL
Horseneck or gaper clam *Tresus capax*	not found AI	not found AU, BS, CJ	242, 243, 271, 351, 400, 440, 441, X, CL
Pacific gaper *Tresus nuttali*	not found AI, BW	not found AU, BS, CJ	80, 229, 351, 400, X, CL
California jacknife clam *Tagelus californianus*	not found AI	not found AU, BS, CJ	rare 271, 351
Pacific littleneck clam *Protothaca staminea*	not found AI, BW	not found AU, BS, CJ	74, 156, 317, 332, 351, 400, X, CL
Manila (Japanese) clam *Venerupis japonica*	not found AI	not found AU, BS, CJ	271, 332, 351, X, CL
Eastern softshell clam *Mya arenaria*	not found AI, BW	not found AU, BS, CJ	351, 357, X, CL
Geoduck *Panope abrupta*	not found AI, BW	not found AU, BS, CJ	rare 351, I, X, CL
Bay shrimp *Crangon franciscorum*	rare BW	rare AU, BS, CJ	175, 199, 218, 219, 351, 374
Dungeness crab *Cancer magister*	AI, BW	AU, BS, CJ	164, 339, 351, 370, D, CH, CL
Leopard shark *Triakis semifasciata*	not found BW	not found AU, BS, CJ	165, 370, D, CL
White sturgeon *Acipenser transmontanus*	BW	78, 138, 415, 416, AU, BS, CJ	rare 165, D, CL
Green sturgeon *Acipenser medirostris*	322, BW	78, 138, 415, 416, AU, BS, CJ	138, 165, 370, CL, D
American shad *Alosa sapidissima*	322, BW	78, 138, 415, 416, AU, BS, CJ	rare 165, D, CL
Pacific herring *Clupea pallasi*	322, BW	AU, BS, CJ	26, 116, 318, 319, 432, D, CB, CL
Northern anchovy *Engraulis mordax*	322, BW	AU, BS, CJ	116, 165, 339, 370, 432, CH, CL, D
Deepbody anchovy *Anchoa compressa*	not found 264	not found 264	not found 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 264	not found 264
Cutthroat trout *Oncorhynchus clarki*	144, 154, 155, 257, 322, 410, BW	78, 98, AU, BS, CJ	rare 165, D, CH, CL
Pink salmon *Oncorhynchus gorbuscha*	rare 322, BW	rare 78, AU, BS, CJ	not found 165, D, CL
Chum salmon *Oncorhynchus keta*	rare 20, BW	rare 78, 415, 416, AU, BS, CJ	rare 165, D, CH, CL
Coho salmon *Oncorhynchus kisutch*	257, 322, 408, 430, BW	78, 415, 416, AU, BS, CJ	138, 165, 271, D, CH, CL
Steelhead *Oncorhynchus mykiss*	88, 120, 233, 322, BW	78, 214, 415, 416, AU, BS, CJ	25, 165, D, CH
Sockeye salmon *Oncorhynchus nerka*	not found BW	not found 415, 416, AU, BS, CJ	not found D, CH, CL
Chinook salmon *Oncorhynchus tshawytscha*	87, 88, 233, 257, 280, 333, 430, BW	78, 415, 416, AU, BS, CJ	165, 271, D, CH, CL
Surf smelt *Hypomesus pretiosus*	322, BW	AU, BS, CJ	116, 165, 339, 370, 454, D, CL, CH
Longfin smelt *Spirinchus thaleichthys*	not found 322, BW	AU, BS, CJ	116, 165, 339, 370, 454, CL, D
Eulachon *Thaleichthys pacificus*	rare 322, BW	138, AU, BN, BS, CJ	rare 165, 454, D, CH, CL
Pacific tomcod *Microgadus proximus*	BW	not found AU, BS, CJ	116, 165, 339, 370, D, BT, CH, CL
Topsmelt *Atherinops affinis*	not found BW	rare AU, BS, CJ	67, 94, 116, 165, 370, D, BT, CL
Jacksmelt *Atherinopsis californiensis*	not found BW	not found AU, BS, CJ	67, 116, 165, 370, D, CH, CL
Threespine stickleback *Gasterosteus aculeatus*	427, BW	427, AU, BS, CJ	67, 165, 370, 427, D, CL
Striped bass *Morone saxatilis*	not found BW	rare AU, BS, CJ	rare 165, D, CH, CL
Kelp bass *Paralabrax clathratus*	not found BW	not found AU, BS, CJ	not found 165
Barred sand bass *Paralabrax nebulifer*	not found BW	AU, BS, CJ	not found 165
White seabass *Atractoscion (=Cynoscion) nobilis*	not found BW	AU, BS, CJ	rare 116, 165, D, CH, CL
White croaker *Genyonemus lineatus*	not found BW	not found AU, BS, CJ	116, 165, 271
Shiner perch *Cymatogaster aggregata*	322, BW	AU, BS, CJ	12, 165, 339, 363, 370, D, CH, CL
Arrow goby *Clevlandia ios*	not found 322, BW	not found AU, BS, CJ	116, 165, 351, 370, D, CH, CL
Pacific sand lance *Ammodytes hexapterus*	not found 322, BW	not found AU, BS, CJ	116, 165, 330, 339, 370, D, CH, CL
Lingcod *Ophiodon elongatus*	not found 322, BW	not found AU, BS, CJ	116, 165, 263, 339, 370, D, CH, CL
Pacific staghorn sculpin *Leptocottus armatus*	116, 203, 322, BW	AU, BS, CJ	67, 116, 165, 339, 351, 370, D, BT, CL
California halibut *Paralichthys californicus*	not found BW	not found AU, BS, CJ	not found 165
Diamond turbot *Hypsopsetta guttulata*	not found 119	not found 119	not found 119
English sole *Pleuronectes vetulus*	rare BW	rare AU, BS, CJ	67, 267, 268, 339, 370, D, CH, CL
Starry flounder *Platichthys stellatus*	144, 322, BW	AU, BS, CJ	67, 116, 165, 339, 351, 370, D, CH, CL
	Rogue River	Klamath River	Humboldt Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Eel River	Tomales Bay	Central San Francisco / Suisun / San Pablo Bays
Blue mussel *Mytilus edulis*	313 270	179, 361	451 CM
Pacific oyster *Crassostrea gigas*	not found 313, 270	27, 35, 36, 375, CF	rare 281, CM
Horseneck or gaper clam *Tresus capax*	not found 313	rare? 168, 383	not found 168, 205, 451, CM
Pacific gaper *Tresus nuttali*	not found 313, 270	81, 135	rare 451, CM
California jacknife clam *Tagelus californianus*	not found 313, 270	not found 128, 168, 331	rare 128, 331, 451, CM
Pacific littleneck clam *Protothaca staminea*	not found 313	128, 135, 304, 305, 355	rare 128, 135, 205, 355, 451, CM
Manila (Japanese) clam *Venerupis japonica*	not found 313	57, 73, 128, 135	57, 205, 451, BC, CM
Eastern softshell clam *Mya arenaria*	313	128, 135	126, 205, 281, 451, BC, CM
Geoduck *Panope abrupta*	not found 270, 313	rare 128, 383	not found CM
Bay shrimp *Crangon franciscorum*	175, 218, 219, 313	175	60, 140, 175, 198, 356, B
Dungeness crab *Cancer magister*	313	309, 445	60, 83, 326, 406, B, CG
Leopard shark *Triakis semifasciata*	not found 270, 313	22, 23	109, 140, 178, 367, CA
White sturgeon *Acipenser transmontanus*	rare 138, BF, BR	rare 22	213 265, 314, 321, 393, L, CD
Green sturgeon *Acipenser medirostris*	rare 138, BF, BR	rare 22	213, 265, 321, L, AX, CD
American shad *Alosa sapidissima*	48, 270, 313	rare 22	140, 207, 389, 391, 392, 394, AX, CD
Pacific herring *Clupea pallasi*	48, 270, 313, CB	174, 377, 379, 380, 381, 401	60, 140, 377, 379, 380, 381, 401, 435, B, CB
Northern anchovy *Engraulis mordax*	270, 313	22, 435	60, 115, 140, 195, 254, 259, 435, B
Deepbody anchovy *Anchoa compressa*	not found 264	not found 22, 264	not found 60, 140, 264
Slough anchovy *Anchoa delicatissima*	not found 264	not found 22, 264	not found 60, 140, 264
Cutthroat trout *Oncorhynchus clarki*	270, 313, AK	not found 138, 274	not found 138, 274
Pink salmon *Oncorhynchus gorbuscha*	not found 270, 313, BF	not found 22	rare 60, 138, 140
Chum salmon *Oncorhynchus keta*	313, BF	not found 22	rare 60, 138, 140
Coho salmon *Oncorhynchus kisutch*	20, 48, 138, 313, BF	22, 352, S	rare 60, 138, 140
Steelhead *Oncorhynchus mykiss*	48, 106, 270, 313	25, 352, S	138, 140, 259, 344, B, BV
Sockeye salmon *Oncorhynchus nerka*	not found 138, 313, BF	not found 22, 138	rare 60, 138, 140
Chinook salmon *Oncorhynchus tshawytscha*	48, 270, 313, 430, BF	22, 138, S	138, 140, 170, 211, 259, 325, 344, 425, J, CD
Surf smelt *Hypomesus pretiosus*	116, 313	22, 435	60, 140, 259, 435, B
Longfin smelt *Spirinchus thaleichthys*	116, 313, 454	rare 22	60, 140, 275, 321, 394, B, CD
Eulachon *Thaleichthys pacificus*	not found 270, 313	not found 22, 264, 292	not found 264, 292
Pacific tomcod *Microgadus proximus*	rare 48, 313	22	rare 60, 140, 259, 435, B
Topsmelt *Atherinops affinis*	313	22, 60, 64, 435	60, 259, B
Jacksmelt *Atherinopsis californiensis*	not found 313	22, 23, 79, 435	60, 79, 140, 435, B
Threespine stickleback *Gasterosteus aculeatus*	48, 313, 427	22	275, 427, 435, B
Striped bass *Morone saxatilis*	rare 48, 313	22	59, 62, 121, 140, 321, 345, 346, 362, 413, 414, AX, CD
Kelp bass *Paralabrax clathratus*	not found 313	not found 22	not found 60, 140, B
Barred sand bass *Paralabrax nebulifer*	not found 313	not found 22	not found 60, 140, 435, B
White seabass *Atractoscion (=Cynoscion) nobilis*	not found 313	rare 22	15, 60, 140, 259, 435, B
White croaker *Genyonemus lineatus*	not found 313	22	60, 115, 140, 157, 259, 435, B
Shiner perch *Cymatogaster aggregata*	12, 313, 363	22, 23, 353, 354	17, 60, 140, 259, B
Arrow goby *Clevlandia ios*	not found 313	22, 60, 311, 435	60, 115, 311, 435, B
Pacific sand lance *Ammodytes hexapterus*	rare 313	115, 435	15, 60, 115, 140, 259, 435, B
Lingcod *Ophiodon elongatus*	not found 313	22, 435	60, 140, 259, 435, B
Pacific staghorn sculpin *Leptocottus armatus*	116, 203, 313	22, 203	60, 140, 203, 435, B
California halibut *Paralichthys californicus*	not found 313	22, 435	115, 435, B
Diamond turbot *Hypsopsetta guttulata*	not found 119	22, 435	114, 140, 414, 435, B
English sole *Pleuronectes vetulus*	267, 268, 313	22, 435	60, 140, 435, B
Starry flounder *Platichthys stellatus*	116, 313	22, 435	60, 140, 321, 435, B

Eel River | Tomales Bay | Central San Francisco / Suisun / San Pablo Bays

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	South San Francisco Bay	Elkhorn Slough	Morro Bay
Blue mussel *Mytilus edulis*	166, 205, 451, CM	168, 179, 289	179, 244
Pacific oyster *Crassostrea gigas*	rare 205, 281, CM	rare 49, 113	153, 244, CF
Horseneck or gaper clam *Tresus capax*	not found 168, 205, 451, CM	not found 241, 289	not found 128, 244
Pacific gaper *Tresus nuttali*	rare 205, 451, CM	80, 81, 229	81, 244, R
California jacknife clam *Tagelus californianus*	not found 128, 331, 451, CM	rare 113, 289, 378	81, 244, R
Pacific littleneck clam *Protothaca staminea*	rare 128, 135, 205, 355, 451, CM	49, 113, 355, 378, CB	153, 244, 304, 355
Manila (Japanese) clam *Venerupis japonica*	57, 128, 205, 451, BC, CM	113, 128, 289, 378, CB	not found 128, 244
Eastern softshell clam *Mya arenaria*	126, 205, 281, 451, BC, CM	113, 289, 378	rare 244, R
Geoduck *Panope abrupta*	not found CM	rare 49, 241	153, R
Bay shrimp *Crangon franciscorum*	60, 175, 210, B, BP	not found 289	not found 244
Dungeness crab *Cancer magister*	60, 83, 406, B, BP, CG	rare 58, 110, O	34, 153, 244, AN
Leopard shark *Triakis semifasciata*	15, 97, 109, 178, CA	1, 10, 29, 404, O	105, 125
White sturgeon *Acipenser transmontanus*	15, 265, L, BP	rare 58, 221, 274, L	not found 125, 244
Green sturgeon *Acipenser medirostris*	15, 265, BP	not found 49, 58, 221, 274	not found 125, 244
American shad *Alosa sapidissima*	15, 207, 362, BP	rare 221, O	not found 187, 244
Pacific herring *Clupea pallasi*	60, 117, 377, 379, 380, 381, 401, 435, B, CB	29, 58, 110, 307, 377	34, 187
Northern anchovy *Engraulis mordax*	15, 60, 115, 254, 435, B, BP	29, 58, 110, AL, O	125, 187
Deepbody anchovy *Anchoa compressa*	not found 15, 60, 264	not found 58, 221, 264	not found 125, 187, 264
Slough anchovy *Anchoa delicatissima*	not found 15, 60, 264	not found 58, 221, 264	not found 125, 187, 264
Cutthroat trout *Oncorhynchus clarki*	not found 138, 274	not found 138, 274	not found 138, 274
Pink salmon *Oncorhynchus gorbuscha*	not found 15, 60	not found 58, 221	not found 34, 125, 187, 208, 244
Chum salmon *Oncorhynchus keta*	not found 15, 60	not found 58, 138, 221	not found 34, 125, 187, 208, 244
Coho salmon *Oncorhynchus kisutch*	rare 15, 60, 138	not found 58, 138, 220, 221	not found 34, 125, 187, 208, 244
Steelhead *Oncorhynchus mykiss*	rare 15, 60, B, BV	not found 58, 220, 221	rare 25, 352, AN, BK
Sockeye salmon *Oncorhynchus nerka*	rare 15, 60, 138	not found 58, 138, 220, 221	not found 34, 125, 187, 208, 244
Chinook salmon *Oncorhynchus tshawytscha*	15, 138, 425, J, CD	not found 58, 138, 220, 221	not found 34, 125, 187, 208, 244
Surf smelt *Hypomesus pretiosus*	15, 435, B, BP	rare 16, 58, 110, O	not found 34, 125, 187, 208, 244, AN
Longfin smelt *Spirinchus thaleichthys*	15, 17, 60, B, BP	not found 58, 220, 264, O	not found 34, 125, 187, 208, 244, 264, AN
Eulachon *Thaleichthys pacificus*	not found 292, 294	not found 264, 292	not found 264, 292
Pacific tomcod *Microgadus proximus*	rare 15, 435, B, BP	rare 58, 220, 221, O	rare 34, 125, 187, 208, 244
Topsmelt *Atherinops affinis*	60, 435, B, BP	58, 110, 324, 434, O, AL	34, 125, 187, 435
Jacksmelt *Atherinopsis californiensis*	60, 79, 435, B	16, 79, 110, 324, 435, O, AL	34, 79, 125, 187, 208, 244, 435, AN, BK
Threespine stickleback *Gasterosteus aculeatus*	15, 435, 450, B	16, 58, 209, 435, O	187, 244, AN
Striped bass *Morone saxatilis*	15, 61, 362, AX, CD	not found 58, 220, 221, O	not found 187, 244, AN
Kelp bass *Paralabrax clathratus*	not found 15, 60, 362	not found 58, 220, 221, O	not found 187, 244, AN
Barred sand bass *Paralabrax nebulifer*	not found 15, 60, 210, 362, 435, B	not found 58, 220, 221, O	not found 187, 244, AN
White seabass *Atractoscion (=Cynoscion) nobilis*	rare 15, 60, 115, BP	not found 58, 220, 221, O	rare 153, 187, 244, AN
White croaker *Genyonemus lineatus*	15, 60, 115, 157, 435, B, BP	58, 209, 236, O, AL	34, 153, 187, 208, 236, 244
Shiner perch *Cymatogaster aggregata*	15, 17, 60, 435, B, BP	14, 16, 28, 58, 209, O	125, 187, AN
Arrow goby *Clevlandia ios*	60, 311, 435, BP	16, 28, 47, 58, 311, 435, AL, O	47, 125, 187, 311, AN
Pacific sand lance *Ammodytes hexapterus*	rare 15, 210, 435, B, BP	58, O, AL	rare 34, 125, 187
Lingcod *Ophiodon elongatus*	rare 15, 435, B, BP	rare 58, 263, O	rare 34, 125, 187, 244, AN
Pacific staghorn sculpin *Leptocottus armatus*	15, 60, 203, 435, B, BP	16, 28, 58, 203, 209, O, AL	125, 187, 203
California halibut *Paralichthys californicus*	435, B, BP	10, 28, 29, 58, 110, 435, O	125, 187, 435
Diamond turbot *Hypsopsetta guttulata*	15, 114, 140, 435, B, BP	10, 58, 209, 435, O	34, 125, 187, 435, AN
English sole *Pleuronectes vetulus*	15, 60, 210, 299, 435, B, BP	10, 28, 29, 58, O	34, 125, 187, AN
Starry flounder *Platichthys stellatus*	15, 60, 435, B, BP	10, 16, 28, 29, 58, O	34, 125, 187, AN
	South San Francisco Bay	Elkhorn Slough	Morro Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.
Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Santa Monica Bay	San Pedro Bay	Alamitos Bay
Blue mussel *Mytilus edulis*	371, F, AW	173, 371, F, AW	168, 272, 327, BU
Pacific oyster *Crassostrea gigas*	not found 128, 371	not found 128, 173, 371	not found 128
Horseneck or gaper clam *Tresus capax*	not found 128, 371	not found 128, 173, 371	not found 128, BU
Pacific gaper *Tresus nuttali*	rare 128, 371	81, 128, 173, 371	rare BU
California jacknife clam *Tagelus californianus*	128, 371, AW	173, 371, AW, BU	AW, BU, BY
Pacific littleneck clam *Protothaca staminea*	304, 305, 355, 371, AW	173, 304, 355, 371, AW	329, 355, AW, BU
Manila (Japanese) clam *Venerupis japonica*	not found 128, 371	not found 128, 173, 371	not found 128, BU
Eastern softshell clam *Mya arenaria*	not found 128, 371	not found 128, 173, 371	not found 128
Geoduck *Panope abrupta*	not found 128	rare 128, 168	not found 168, 329
Bay shrimp *Crangon franciscorum*	not found 371	not found 173, 371	not found 329
Dungeness crab *Cancer magister*	not found 142	not found 142	not found 142
Leopard shark *Triakis semifasciata*	1, 122, 237, CC	1, 8, 66, 123, 189, 192, CC	rare 7, 212, A, AN
White sturgeon *Acipenser transmontanus*	not found 122, 237, CC	not found 8, 66, 123, 189, 192, CC	not found 7
Green sturgeon *Acipenser medirostris*	not found 122, 185, 237, CC	not found 8, 66, 123, 189, 192, CC	not found 7, 212
American shad *Alosa sapidissima*	Rare 6, 122, 185, 274, CC	rare 6, 8, 66, 123, 189, 192, 274	not found 7
Pacific herring *Clupea pallasi*	rare 377	rare 377	not found 7, 212, 377
Northern anchovy *Engraulis mordax*	6, 8, 45, 46, 196, 226, 237, 388, T, CC	6, 8, 45, 46, 196, 388, T, CC	6, 7, 45, 46, 388, A, AN
Deepbody anchovy *Anchoa compressa*	rare 237, CC	5, 6, 8, 192, 237, 371, 388	7, 176, A, AN
Slough anchovy *Anchoa delicatissima*	not found 237, CC	rare 8, 192, 230, 237, 371, CC	7, 176, A, AN
Cutthroat trout *Oncorhynchus clarki*	not found 138, 274	not found 138, 274	not found 138, 274
Pink salmon *Oncorhynchus gorbuscha*	not found 5, 185, 237, 373, AN	not found 5, 6, 185, 185, 189, 237	not found 7, A, AN
Chum salmon *Oncorhynchus keta*	not found 5, 185, 237, 373, AN	not found 5, 6, 185, 189, 237	not found 7, A, AN
Coho salmon *Oncorhynchus kisutch*	not found 5, 185, 237, 373, AN	not found 5, 6, 185, 237	not found 7, A, AN
Steelhead *Oncorhynchus mykiss*	not found 25, 138, 274	not found 25, 138, 274	not found 25, 138, 274
Sockeye salmon *Oncorhynchus nerka*	not found 5, 185, 237, 373, AN	not found 5, 6, 185, 237	not found 7, A, AN
Chinook salmon *Oncorhynchus tshawytscha*	rare 5, 9, 138, 185, 237, 373	rare 5, 6, 9, 138, 185, 237	not found 7, A, AN
Surf smelt *Hypomesus pretiosus*	not found 5, 185, 237, 373	not found 5, 6, 185, 189, 237	not found 328
Longfin smelt *Spirinchus thaleichthys*	not found 185, 264	not found 185, 264, 274	not found 264, 274
Eulachon *Thaleichthys pacificus*	not found 264	not found 264	not found 264
Pacific tomcod *Microgadus proximus*	not found 185, 264	not found 185, 264	not found 264
Topsmelt *Atherinops affinis*	6, 123, 371, 372, CC	5, 8, 123, AN, CC	7, 231, 232, A, AN
Jacksmelt *Atherinopsis californiensis*	6, 79, 123, 371, 372, CC	79, 123, 185, 192, AN, CC	not found 7, 189, A, AN
Threespine stickleback *Gasterosteus aculeatus*	not found 188, AN	not found 185, AN, CC	not found 7, 189, A, AN
Striped bass *Morone saxatilis*	not found 188, AN	not found 185, AN, CC	not found 7, 189, A, AN
Kelp bass *Paralabrax clathratus*	8, 55, 62, 122, 123, 225, 286, 365, 373, 455, T, CC	55, 185, 192, 315, 365, 371, 388, 455, AN, CC	rare 7, 189, A, AN
Barred sand bass *Paralabrax nebulifer*	62, 122, 123, 135, 225, T, AH, CC	123, 135, 173, 192, 225, AH, CC	7, 212, 231, 232, A, AN
White seabass *Atractoscion (=Cynoscion) nobilis*	135, 273, 382, T, CC	8, 66, 185, 189, AN, CC	not found 7, 328, A, AN
White croaker *Genyonemus lineatus*	62, 89, 122, 157, 236, T, AH, CC	8, 173, 189, 192, 236, 237, 306, 371, 388, AN, CC	7, 236, A, AN
Shiner perch *Cymatogaster aggregata*	122, 185, 373, 371, 386, 387, T, AH, CC	8, 66, 192, 373, 386, 387, 388, CC	7, A, AN
Arrow goby *Clevlandia ios*	rare 62, 122, 371, CC	8, 173, 186, 231, 232, 371, CC	7, 231, 232, 240, A, AN
Pacific sand lance *Ammodytes hexapterus*	not found 185, 188, AN	not found 185, AN, CC	not found 7, A, AN
Lingcod *Ophiodon elongatus*	rare 62, 122, 123, 263	rare 123, 189, 263	not found 7, A, AN
Pacific staghorn sculpin *Leptocottus armatus*	rare 122, 203, 373, T, CC	rare 8, 189, T, CC	7, 231, 232, 405, A, AN
California halibut *Paralichthys californicus*	2, 62, 122, 167, 230, 435, T, CC	8, 66, 167, 189, 192, 230, 373, 387, 388, CC	7, 167, A
Diamond turbot *Hypsopsetta guttulata*	62, 122, 222, 373, 371, T, CC	8, 189, 192, 222, 387, 388, CC	7, 222, A
English sole *Pleuronectes vetulus*	2, 52, 62, 122, 206, 373, T, CC	8, 173, 231, 232, 371, 387, 388, T, CC	rare 7,A
Starry flounder *Platichthys stellatus*	not found 62, 122, 185, 373	8, 185, 387, 388, CC	not found 7,A

Santa Monica Bay San Pedro Bay Alamitos Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	Anaheim Bay	Newport Bay	Mission Bay
Blue mussel *Mytilus edulis*	168, 272, 327, 329, BU	168, 272, 327, BY	AW
Pacific oyster *Crassostrea gigas*	not found 128	not found 128	not found 128
Horseneck or gaper clam *Tresus capax*	not found 329, BU	not found 348, 349, BY	not found 69, 99, 128, 282
Pacific gaper *Tresus nuttali*	rare 329, BU	rare 348, 349, BU, BY	rare 69, 99, 282
California jacknife clam *Tagelus californianus*	329, AW, BU	348, 349, AW, BY	69, AW
Pacific littleneck clam *Protothaca staminea*	329, 355, AW, BU	348, 349, AW, BY	69, 99, 282
Manila (Japanese) clam *Venerupis japonica*	not found 128	not found 128, 348, 349, BY	not found 69, 99, 128, 282
Eastern softshell clam *Mya arenaria*	not found 128	not found 128	not found 128
Geoduck *Panope abrupta*	not found 329, 376	not found 348, 349	not found 69, 282
Bay shrimp *Crangon franciscorum*	not found 329, 376	not found BY	not found 282
Dungeness crab *Cancer magister*	not found 142	not found 142	not found 142
Leopard shark *Triakis semifasciata*	rare 212	rare 3, 190	rare 69, 282
White sturgeon *Acipenser transmontanus*	not found 212, 223	not found 3, 190	not found 69, 282
Green sturgeon *Acipenser medirostris*	not found 212, 223	not found 3, 190	not found
American shad *Alosa sapidissima*	not found 212, 223	not found 3, 21, 190, A, AN	not found 69, 282
Pacific herring *Clupea pallasi*	not found 212, 223, 376, 377, A, AN	rare 3, 21, 190, 377, A, AN	rare 69, 282, 377, Z, AC, AY, BL
Northern anchovy *Engraulis mordax*	102, 212, 231, 232, A, AN	4, 21, 111, 190, 443, A, AN	50, 255, 282,369
Deepbody anchovy *Anchoa compressa*	102, 212, 231, 232, A, AN	3, 4, 176, 190, 443, A, AN	282, BL
Slough anchovy *Anchoa delicatissima*	rare 102, 212, 231, 232, A, AN	3, 4, 176, 190, 443, A, AN	282, BL
Cutthroat trout *Oncorhynchus clarki*	not found 138, 274	not found 138, 274	not found 138, 274
Pink salmon *Oncorhynchus gorbuscha*	not found 102, 212, 231, 232, A, AN	not found 3, 4, 190, A, AN	not found 69, 282, AM
Chum salmon *Oncorhynchus keta*	not found 102, 212, 231, 232, A, AN	not found 3, 4, 190, A, AN	not found 69, 282, AM
Coho salmon *Oncorhynchus kisutch*	not found 102, 212, A, AN	not found 3, 4, 190, A, AN	not found 69, 282, AM
Steelhead *Oncorhynchus mykiss*	not found 25, 138, 274	not found 25, 138, 274	not found 25, 138, 274
Sockeye salmon *Oncorhynchus nerka*	not found 102, 212, A, AN	not found 3, 4, 190, A, AN	not found 69, 282, AM
Chinook salmon *Oncorhynchus tshawytscha*	not found 102, 212, A	not found 3, 4, 190, A, AN	not found 69, 282, AM
Surf smelt *Hypomesus pretiosus*	not found 102, 212, A	not found 3, 4, 190, A, AN	not found 69, 282
Longfin smelt *Spirinchus thaleichthys*	not found 264, 274	not found 264, 274	not found 264, 274
Eulachon *Thaleichthys pacificus*	not found 264	not found 264	not found 264
Pacific tomcod *Microgadus proximus*	not found 264	not found 264	not found 264
Topsmelt *Atherinops affinis*	137, 212, 231, 232, 347, A, AN	3, 4, 137, 190, 347, 443, A, AN	69, 282, 347, AC, AM, AY, Z
Jacksmelt *Atherinopsis californiensis*	not found 188, 212, A, AN	rare 4, A, AN	79, 282, Z, AC, AY
Threespine stickleback *Gasterosteus aculeatus*	not found 188, 212, A, AN	not found 4, A, AN	not found 282, Z, AC, AY
Striped bass *Morone saxatilis*	rare 212, 320, A, AN	rare 21, 191, A, AN	69, 282, AC, Z
Kelp bass *Paralabrax clathratus*	rare 102, 212, A	rare 3, 4, 21, 190, 443, A, AN	69, 282, Z, AC, AM, AY
Barred sand bass *Paralabrax nebulifer*	212, 231, 232, A	3, 21, 190, 443, A, AN	69, 216, 282, Z, AC, AM, AY
White seabass *Atractoscion (=Cynoscion) nobilis*	rare 102, 212, 231, 232, A, AN	rare 3, 4, 21, 190, 443, A, AN	rare 69, 216, 282, Z, AC,AY
White croaker *Genyonemus lineatus*	102, 212, 231, 232, 236, A, AN	3, 4, 21, 190, 236, 443, A, AN	69, 236, 255, 282, 439, AC
Shiner perch *Cymatogaster aggregata*	293, A	3, 4, 21, 190, A, AN	69, 282, Z, AC, AY, Z
Arrow goby *Clevlandia ios*	231, 232, 240, A	4, 111, 443, A	47, 282, 311, 369, Z, AC, AY
Pacific sand lance *Ammodytes hexapterus*	not found 102, 212, 231, 232, A, AN	not found 3, 4, 21, 190, 443, A, AN	not found 282, Z, AC, AY
Lingcod *Ophiodon elongatus*	not found 102, 212, 231, 232, A, AN	not found 3, 4, 21, 190, 443, A, AN	not found 282, Z, AC, AY
Pacific staghorn sculpin *Leptocottus armatus*	231, 232, 405, A	rare 3, 21, 190, 443, A, AN	282, Z, AC, AY
California halibut *Paralichthys californicus*	167, 231, 232	3, 4, 21, 190, 443, A, AN	216, 255, 282, Z, AC, AM, AY
Diamond turbot *Hypsopsetta guttulata*	231, 232, 222, A	4, 190, 443, A, AN	69, 255, 282, Z, AC, AY
English sole *Pleuronectes vetulus*	rare 102, 212, A	rare 4, A, AN	rare 69, 282, Z, AC, AY
Starry flounder *Platichthys stellatus*	not found 102, 212, A	not found 4, 190, A, AN	not found 69, 282, Z, AC, AY
	Anaheim Bay	Newport Bay	Mission Bay

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 3 (continued). Table of references and personal communications.

Common/Scientific Name	San Diego Bay	Tijuana Estuary
Blue mussel *Mytilus edulis*	50, AC, AW	456, BM
Pacific oyster *Crassostrea gigas*	not found 128	not found 128
Horseneck or gaper clam *Tresus capax*	not found 50, 128, 129, 130, 341, 342, 343, AC, BA	not found 128, 284, 456, BM
Pacific gaper *Tresus nuttali*	rare 50, 130, 341, 342, 343, AC	rare 284, 456, BM
California jacknife clam *Tagelus californianus*	258, AC, AW	284, 456, BM
Pacific littleneck clam *Prototthaca staminea*	50, 129, 130, 341, 342, 343, AC, BA	284, 456, BM
Manila (Japanese) clam *Venerupis japonica*	not found 50, 128, 129, 130, 341, 342, 343, AC, BA	not found 128, 284, 456, BM
Eastern softshell clam *Mya arenaria*	not found 128	not found 128
Geoduck *Panope abrupta*	not found 50	not found 456
Bay shrimp *Crangon franciscorum*	not found 50, 129, 130, AC	not found 284, 456, BM
Dungeness crab *Cancer magister*	not found 142	not found 142, 284, 456, BM
Leopard shark *Triakis semifasciata*	rare 129, 130, 235, 341, 342, 343	not found 285, 456
White sturgeon *Acipenser transmontanus*	not found 129, 130, 235, 341, 342, 343	not found 456
Green sturgeon *Acipenser medirostris*	not found 50, 129, 130, 235, 341, 342, 343	not found 456
American shad *Alosa sapidissima*	not found 50, 129, 130, 235, 341, 342, 343	not found 456
Pacific herring *Clupea pallasi*	rare 50, 377, AC	not found 456, BM
Northern anchovy *Engraulis mordax*	50, 129, 130, 255, 256, 341, 342, 343, AC	283, 456, BM
Deepbody anchovy *Anchoa compressa*	183, 255, 256, 341, 342, 343, AC	rare 283, 456, BM
Slough anchovy *Anchoa delicatissima*	129, 130, 255, 256, 341, 342, 343, AC	rare 283, 456, BM
Cutthroat trout *Oncorhynchus clarki*	not found 138, 274	not found 138, 274
Pink salmon *Oncorhynchus gorbuscha*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Chum salmon *Oncorhynchus keta*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Coho salmon *Oncorhynchus kisutch*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Steelhead *Oncorhynchus mykiss*	not found 25, 138, 274	not found 25, 138, 274
Sockeye salmon *Oncorhynchus nerka*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Chinook salmon *Oncorhynchus tshawytscha*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Surf smelt *Hypomesus pretiosus*	not found 129, 130, 183, 235, 302, 341, 342, 343	not found 283, 456, BM
Longfin smelt *Spirinchus thaleichthys*	not found 264, 274	not found 264, 274
Eulachon *Thaleichthys pacificus*	not found 264	not found 264
Pacific tomcod *Microgadus proximus*	not found 264	not found 264
Topsmelt *Atherinops affinis*	129, 130, 183, 347, 341, 342, 343, AC	283, 284, 456, BM
Jacksmelt *Atherinopsis californiensis*	50, 79, 129, 130, 235, AC	not found 283, 284, 456, BM
Threespine stickleback *Gasterosteus aculeatus*	not found 50, 129, 130, 235, AC	not found 283, 284, 456, BM
Striped bass *Morone saxatilis*	not found 50, 129, 130, 235, 341, 342, 343, AC	not found 283, 284, 456, BM
Kelp bass *Paralabrax clathratus*	rare 129, 130, 183, 255, 256, 341, 342, 343, AC	rare 283, 284, 456, BM
Barred sand bass *Paralabrax nebulifer*	129, 130, 183, 235, 255, 256, 302, 341, 342, 343, AC	rare 283, 284, 444, 456, BM
White seabass *Atractoscion (=Cynoscion) nobilis*	rare 129, 130, 183, 235, 255, 256, AC, BM	rare 283, 284, 456, BM
White croaker *Genyonemus lineatus*	129, 130, 235, 236, 244, 255, 256, 341, 342, AC	283, 284, 456, BM
Shiner perch *Cymatogaster aggregata*	129, 130, 183, 341, 342, 343, AC	rare 283, 284, 456, BM
Arrow goby *Clevlandia ios*	47, 129, 130, 183, 255, 256, 282, 311, 341, 342, 343, AC	283, 284, BM
Pacific sand lance *Ammodytes hexapterus*	not found 129, 130, 183, 255, 256, 341, 342, 343, AC	not found 283, 284, 456, BM
Lingcod *Ophiodon elongatus*	129, 130, 183, 255, 256, 341, 342, 343, AC	not found 283, 284, 456, BM
Pacific staghorn sculpin *Leptocottus armatus*	129, 130, 183, 255, 256, 341, 342, 343, AC	283, 284, 456, BM
California halibut *Paralichthys californicus*	129, 130, 183, 216, 235, 255,256, 302, 341, 342, 343, AC 343, AC	283, 284, 456, BM
Diamond turbot *Hypsopsetta guttulata*	129, 130, 183, 255, 256, 302, 341, 342, 343, AC	283, 284, 456, BM
English sole *Pleuronectes vetulus*	not found 129, 130, 183, 255, 256, 302, 341, 342, 343	not found 283, 284, 456, BM
Starry flounder *Platichthys stellatus*	not found 129, 130, 183, 255, 256, 302, 341, 342, 343, AC	not found 283, 284, 456, BM
	San Diego Bay	Tijuana Estuary

Numbers correspond to references listed in Appendix 5, References, pp. 219 - 240.

Letters correspond to individuals listed in Appendix 4, Personal Communications, pp. 216 - 218.

Appendix 4. Personal Communications

Letter Code*	Name	Affiliation
A	Allen, L.	California State University, Northridge, CA.
B	Armor, C.	California Department of Fish and Game, Stockton, CA.
C	Armstrong, D.	University of Washington, Seattle, WA.
D	Barnhart, R.	U. S. Fish and Wildlife Service, Coop. Fish. Research Unit, Arcata, CA.
E	Baumgarner, R.	Washington Department of Fisheries, Brennon, WA.
F	Bay, S.	Southern California Coastal Water Research Project, Longbeach, CA.
G	Beidler, W.	Oregon Department of Fish and Wildlife, Newport, OR.
H	Bottom, D.	Oregon Department of Fish and Wildlife, Corvallis, OR.
I	Boyd, M	Humboldt State University, Arcata, CA.
J	Brandis, P.	U.S. Fish and Wildlife Service, Stockton, CA.
K	Brawn, K.	Oregon Department of Fish and Wildlife, Tillamook, OR
L	Brennon, J.	Moss Landing Marine Laboratories, Moss Landing, CA.
M	Brix, R.	Washington Department of Fisheries, Montesano,WA.
N	Butler, J.	Oregon Department of Fish and Wildlife, Newport, OR.
O	Cailliet, G.	Moss Landing Marine Laboratories, Moss Landing, CA.
P	Chapman, J.	Hatfield Marine Science Center, Newport, OR.
Q	Chung, A.	Oregon State University, Corvallis, OR.
R	Clogston, F.	California Polytechnic State University, San Luis Obispo, CA.
S	Cox, W.	California Department of Fish and Game, Sebistopol, CA.
T	Cross, J.	Southern California Coastal Water Research Project, Long Beach, CA.
U	Culver, B	Washington Department of Fisheries, Montesano, WA.
V	Dawley, E.	National Marine Fisheries Service, Hammond, OR.
W	DeBen, W.	U.S. Environmental Protection Agency, Newport, OR.
X	DeMartini, J.	Humboldt State University, Arcata, CA.
Y	Dinnel, P.	University of Washington, Seattle, WA.
Z	Donaho, C.	Sea World Res. Institute, San Diego, CA.
AA	Emmett, R.	National Marine Fisheries Service, Hammond, OR.
AB	Fisher, J.	Oregon State University, Corvallis, OR.
AC	Ford, R.	San Diego State University, San Diego, CA.
AD	Fresh, K.	Washington Department of Fisheries, Olympia, WA.
AE	Freymond, W.	Washington Department of Game, Olympia, WA.
AF	Gilbreath, L.	National Marine Fisheries Service, North Bonneville, WA.
AG	Galbreath, J.	Oregon Department of Fish and Wildlife, Clackamas, OR.
AH	Garrahan, P.	Occidental College, Vantuna Research Group, Los Angeles, CA.

* Letter code corresponds to Appendix 3, Table of References and Personal Communications, pp. 205-215.

Letter Code*	Name	Affiliation
AI	Gaumer, T.	Oregon Department of Fish and Wildlife, Newport, OR.
AJ	Goodwin, L.	Washington Department of Fisheries, Brennon, WA.
AK	Gerstung, E.	California Department of Fish and Game, Rancho Cordova, CA.
AL	Hayden, W.	Moss Landing Marine Laboratories, Moss Landing, CA.
AM	Hoffman, R.	National Marine Fisheries Service, Terminal Island, CA.
AN	Horn, M.	California State University, Fullerton, CA.
AO	Horton, H.	Oregon State University, Corvallis, OR.
AP	Hueckel, G.	Washington Department of Fisheries, Olympia, WA.
AQ	Hurlburt E.	Washington Department of Fisheries, Olympia, WA.
AR	Johnson, J.	Oregon Department of Fish and Wildlife, Reedsport, OR.
AS	Johnston, J.	Washington Department of Game, Bellingham, WA.
AT	King, S.	Oregon Department of Fish and Wildlife, Clackamas, OR.
AU	Kisanuki, T.	U.S. Fish and Wildlife Service, Arcata, CA.
AV	Knispel, W.	Oregon Department of Fish and Wildlife, Seaside, OR.
AW	Knaggs, E.	California Department of Fish and Game, Sacramento, CA.
AX	Kohlhorst, D.	California Department of Fish and Game, Stockton, CA.
AY	Kramer, S.	National Marine Fisheries Service, La Jolla, CA.
BZ	Kreitman, G.	Washington Department of Fisheries, Olympia, WA.
BA	Lester, W.	Westec Services, Inc., San Diego, CA.
BB	Lock, J.	Washington Department of Game, Kalama, WA.
BC	McAllister, R.	California Department of Fish and Game, Monterey, CA.
BD	McCabe, G., Jr.	National Marine Fisheries Service, Hammond, OR.
BE	McCleod, J.	Oregon Department of Fish and Wildlife, Florence, OR.
BF	McLeod, D.	California Department of Fish and Game, Eureka, CA.
BG	McConnell, R.	National Marine Fisheries Service, Hammond, OR.
BH	McNeil, W.	Hatfield Marine Science Center, Newport, OR.
BI	Miller, B.	University of Washington, Seattle, WA.
BJ	Mullarkey, W.	Oregon Department of Fish and Wildlife, Charleston, OR.
BK	Nakumura, R.	California Polytechnic State University, San Luis Obispo, CA.
BL	Noah, M.	U.S. Corps of Engineers, Los Angeles, CA.
BM	Nordby, C.	San Diego State University, San Diego, CA.
BN	Orcutt, M.	Hoopa Valley Tribe, Hoopa, CA.
BO	Orrell, R.	Washington Department of Fisheries, Mount Vernon, WA.
BP	Pearson, D.	National Marine Fisheries Service, Tiburon, CA.
BQ	Penttila, D.	Washington Department of Fisheries, Seattle, WA.
BR	Preston, L.	California Department of Fish and Game, Eureka, CA.

* Letter code corresponds to Appendix 3, Table of References and Personal Communications, pp. 205-215.

Letter Code*	Name	Affiliation
BS	Pisano, M.	California Department of Fish and Game, Arcata, CA.
BT	Quirollo, L.	California Department of Fish and Game, Eureka, CA.
BU	Reish, D.	California State University, Long Beach, CA.
BV	Requel, P.	California Department of Fish and Game, Stockton, CA.
BW	Riikula, A.	Oregon Department of Fish and Wildlife, Gold Beach, OR.
BX	Scholls, A.	Washington Department of Fisheries, Brennon, WA.
BY	Seapy, R.	California State University, Fullerton, CA.
BZ	Simenstad, C. A.	University of Washington, Seattle, WA.
CA	Smith, S.	National Marine Fisheries Service, La Jolla, CA.
CB	Spratt, J.	California Department of Fish and Game, Monterey, CA.
CC	Stephens, J.	Occidental College, Vantuna Research Group, Los Angeles, CA.
CD	Stevens, D.	California Department of Fish and Game, Stockton, CA.
CE	Stewart, G.	Oregon Department of Fish and Wildlife, Newport, OR.
CF	Swartzell, P.	California Department of Fish and Game, Menlo Park, CA.
CG	Tasto, R.	California Department of Fish and Game, Menlo Park, CA.
CH	Toole, C.	University of Califonia Cooperative Extension, Eureka, CA.
CI	Tufts, D.	Washington Department of Fisheries, Ocean Park, WA.
CJ	Tuss, C.	U.S. Fish and Wildlife Service, Arcata, CA.
CK	Walters, G.	National Marine Fisheries Service, Seattle, WA.
CL	Warner, R.	California Department of Fish and Game, Eureka, CA.
CM	Wooster, T.	California Department of Fish and Game, Yountville, CA.

* Letter code corresponds to Appendix 3, Table of References and Personal Communications, pp. 205-215.

Appendix 5. References

1.* Ackerman, L. T. 1971. Contributions to the biology of the leopard shark, *Triakis semifasciata* (Girard) in Elkhorn Slough, Monterey Bay, California. M.A. thesis, Sacramento State Coll., Sacramento, 54 p.

2. Ahlstrom, E. H., and H. G. Moser. 1975. Distributional atlas of fish larvae in the California current region: flatfishes, 1955 through 1960. Calif. Coop. Ocean. Fish. Invest., Atlas No. 23, 207 p.

3. Allen, L. G. 1976. Abundance, diversity, seasonality and community structure of the fish populations of Newport Bay, California. M.A. Thesis, Calif. State Univ., Fullerton, 107 p.

4. Allen, L. G. 1982. Seasonal abundance, composition, and productivity of the littoral fish assemblage in upper Newport Bay, California. Fish. Bull., U.S. 80(4):769-790.

5. Allen, L. G. 1985. A habitat analysis of the nearshore marine fishes from southern California. Bull. South. Calif. Acad. Sci. 84(3):133-155.

6. Allen, L. G., and E. E. DeMartini. 1983. Temporal and spatial patterns of nearshore distribution and abundance of the pelagic fishes off San Onofre-Oceanside, California. Fish. Bull., U.S. 81(3):569-586.

7. Allen, L. G.,and M. H. Horn. 1975. Abundance, diversity and seasonality of fishes in Colorado Lagoon, Alamitos Bay, California. Est. Coast. Mar. Sci. 3:371-380.

8. Allen, L. G., M. H. Horn, F. A. Edmands II, and C. A. Usui. 1983. Structure and seasonal dynamics of the fish assemblage in the Cabrillo Beach area of Los Angeles Harbor, California. Bull. South. Calif. Acad. Sci. 82(2):47-70.

9. Allen, M. A., and T. J. Hassler. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—chinook salmon. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.49). U.S. Army Corps Eng., TR EL-82-4, 26 p.

10. Ambrose, D. A. 1976. The distribution, abundance, and feeding ecology of four species of flatfish in the vicinity of Elkhorn Slough, California. M.S. thesis, San Jose State Univ., San Jose, CA, 118 p.

11. Andersen, A. M., Jr. 1971. Spawning, growth, and spatial distribution of the geoduck clam, *Panope generosa* Gould, in Hood Canal, Washington. Ph.D. thesis, Univ. Wash., Seattle, 118 p.

12. Anderson, R. D. 1969. Age and growth of three surfperches (Family Embiotocidae) from Arcata Bay, California. M.S. Thesis, Humboldt State Univ., Arcata, CA. 69 p.

13. Andrews, R. E. 1959. Factors influencing the seaward migration of smolt steelhead trout, *Salmo gairdnerii gairdnerii,* Richardson in the Alsea River, Oregon. M.S. thesis, Oregon State Univ., Corvallis.

14. Antrim, B. S. 1981. Habitat and food resource utilization of three species of embiotocids in Elkhorn Slough, Monterey Bay, California. M.A. Thesis, Calif. State Univ., Fresno, 86 p.

15. Aplin, J. A. 1967. Biological survey of San Francisco Bay. 1963-1966. MRO Ref. No. 67-4. Calif. Dept. Fish Game, Menlo Park, 131 p.

16. Appiah, J. C., Jr. 1977. Species composition and abundance of fish populations in Bennett Slough, Monterey Bay, California. M.A. thesis, Calif. State Univ., Fresno, 64 p.

17. Armor, C., and P. L. Herrgesell. 1985. Distribution and abundance of fishes in San Francisco Bay estuary between 1980 and 1982. Hydrobiol. 129:211-227.

18. Armstrong, D. A., J. L. Armstrong, and D. R. Gunderson. 1986. Juvenile Dungeness crab population dynamics in Grays Harbor and Willapa Bay and along the adjacent coast, spring and summer, 1985. Final Rept. to Evans-Hamilton, Inc. and U.S. Army Corps of Eng., Seattle, WA, 46 p.

19. Armstrong, D. A., G. G. Stevens, and J. C. Hoeman. 1982. Distribution and abundance of Dungeness crab and *Crangon* shrimp, and dredging-related mortality of invertebrates and fish in Grays Harbor, Washington. Tech. Rept. to Wash. Dept. Fish. and U.S. Army Corps Eng. School of Fish., Univ. Wash., Seattle, 349 p.

20. Atkinson, C. E., J. H. Rose, and T. O. Duncan. 1967. Pacific salmon in the United States. *In* Salmon of the north Pacific Ocean, part IV, p. 43-225. Int. No. Pac. Fish. Comm. Bull. No. 23.

21. Bane, G. W. 1968. Fishes of the upper Newport Bay. Mus. Syst. Biol., Univ. Calif. Irvine Res. Ser. 3:1-114.

* Number code corresponds to Appendix 3, Table of References and Personal Communications, pp. 205-215.

22. Bane, G. W., and A. W. Bane. 1971. Bay fishes of northern California with emphasis on the Bodega Tomales Bay area. Mariscos Publ., Hampton Bays, NY, 143 p.

23. Banerjee, T. 1966. Survey of the fishes of Tomales Bay with notes on the life history of the white seaperch, *Phanerodon furcatus* Girard. M.S. Thesis, Univ. of the Pacific, Stockton, CA, 81 p.

24. Bargmann, G. G. 1982. The biology and fisheries for lingcod (*Ophiodon elongatus*) in Puget Sound. Tech. Rept. No. 66, Wash. Dept. Fish., Olympia, 69 p.

25. Barnhart, R. A. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—steelhead. U.S. Fish Wildl. Serv. Biol. Rept. 82(11.60). U.S. Army Corps of Eng., TR EL-82-4, 21 p.

26. Barnhart, R. A. 1988. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)-Pacific herring. U.S. Fish and Wildl. Serv., Biol. Rept. 82(11.79). U.S. Army Corps Eng., TR EL-82-4, 14 p.

27. Barrett, E. M. 1963. The California oyster industry. Calif. Fish Game, Fish Bull. 34, 103 p.

28. Barry, J. P. 1983. Utilization of shallow marsh habitats by fishes in Elkhorn Slough. M.A. Thesis, San Jose State Univ., San Jose, CA, 95 p.

29. Barry, J. P., and G. M. Cailliet. 1981. The utilization of shallow marsh habitats by commercially important fishes in Elkhorn Slough, California. Calif.-Nev. Wildl. Trans. 1981:38-47.

30. Bayer, R. D. 1979. Intertidal shallow-water fishes and selected macroinvertebrates in the Yaquina estuary, Oregon. Unpub. rept., 134 p., Oregon State Univ., Newport.

31. Bayer, R. D. 1981. Shallow-water intertidal ichthyofauna of the Yaquina estuary, Oregon. Northw. Sci. 55(3):182-193.

32. Beardsley, A. J. 1969. Movement and angler use of four foodfishes in Yaquina Bay, Oregon. Ph.D. thesis, Oregon State Univ., Corvallis, 173 p.

33. Beardsley, A. J., and C. Bond. 1970. Field guide to common marine and bay fishes of Oregon. Agr. Exp. Sta. Bull. 607, Oregon State Univ., Corvallis, 27 p.

34. Behrans, D. W., and D. C. Sommerville. 1982. Impingement studies at Morro Bay power plant. Rept. 026.22-80.1. Pac. Gas and Elect. Co., Dept. Eng. Res., 127 p. plus appendices.

35. Berg, C. J., Jr. 1969. Seasonal gonadal changes of adult oviparous oysters in Tomales Bay, California. Veliger 12(1):27-36.

36. Berg, C. J., Jr. 1971. A review of possible causes of mortality of oyster larvae of the genus *Crassostrea* in Tomales Bay, California. Calif. Fish Game 57(1):69-75.

37. Blackburn, J. E. 1973. Pelagic eggs and larval fish of Skagit Bay. *In* Q. J. Stober, and E. O. Salo (editors), Ecological studies of the proposed Kiket Island nuclear power site, p. 71-118. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, FRI-UW-7304.

38. Boehlert, G., and B. C. Mundy. 1987. Recruitment dynamics of metamorphosing English sole, *Parophrys vetulus*, to Yaquina Bay, Oregon. Est. Coast. Shelf Sci. 25:261-281.

39. Bottom, D. L., and B. Forsberg. 1978. The fishes of Tillamook Bay. Fed. Aid Prog. Rept., Fish., Oregon Dept. Fish Wildl., Corvallis, 55 p.

40. Bottom, D. L., K. K. Jones, and M. J. Herring. 1984. Fishes of the Columbia River estuary. Columbia River Data Development Program, Columbia River Estuary Study Taskforce, Astoria, OR, 113 p. plus appendices.

41. Bottom, D. L., K. K. Jones, and J. D. Rodgers. 1988. Fish community structure, standing crop, and production in upper South Slough (Coos Bay), Oregon. NOAA Tech. Rept. Ser. OCRM/SPD, 69 p.

42. Bottom, D. L., B. A. Miller, and K. K. Jones. 1985. A baseline survey of fish and invertebrates in the lower Umpqua River estuary, Oregon. Draft Rept., 80 p. Oregon Dept. Fish and Wildl, Corvallis.

43. Bourne, N., and D. W. Smith. 1972. Breeding and growth of the horse clam, *Tresus capax* (Gould), in southern British Columbia. Proc. Natl. Shellfish Assoc. 62:38-48.

44. Breed-Willeke, G. M., and D. R. Hancock. 1980. Growth and reproduction of a subtidal population of the gaper clam, *Tresus capax* (Gould) from Yaquina Bay, Oregon. Proc. Natl. Shellfish. Assoc. 70:1-13.

45. Brewer, G. D. 1975. The biology and fishery of the northern anchovy in San Pedro Bay: potential impact of dredging and landfill. *In* D. F. Soule and M. Oguri (editors), Marine studies of San Pedro Bay, California. Part 8. Environmental biology, p. 23-43. Allan Hancock Found., and Sea Grant Prog., Univ. South. Calif., Los Angeles.

46. Brewer, G. D. 1978. Reproduction and spawning of the northern anchovy, *Engraulis mordax*, in San Pedro Bay, California. Calif. Fish Game 64(3):175-184.

47. Brothers, E. B. 1975. The comparative ecology and behavior of three sympatric California gobies. Ph. D. thesis, Univ. Calif., San Diego, 365 p.

48. Brown, L. R. 1988. The fishes of the Eel River drainage: a review and annotated bibliography. Unpubl. Rept., 71 p. , Univ. Calif., Davis.

49. Browning, B. M., J. A. Aplin, G. L. Gerdes, D. S. Pine, W. E. Stienecker, and J. W. Speth. 1972. The natural resources of Elkhorn Slough, their present and future use. Coast. Wetl. Ser. No. 4, Calif. Dept. Fish Game, Sacramento, 105 p. plus appendices.

50. Browning, B. M., J. W. Speth, and W. Gayman. 1973. The natural resources of San Diego Bay, their status and future. Coast. Wetl. Ser. No. 5, Calif. Dept. Fish Game, Sacramento, 105 p. plus appendices.

51. Buckley, R., G. Hueckel, B. Benson, S. Quinnell, and M. Canfield. 1984. Enhancement research on lingcod (*Ophiodon elongatus*) in Puget Sound. Prog. Rept. No. 216, Wash. Dept. Fish., Olympia, 93 p.

52. Budd, P. L. 1940. Development of the eggs and early larvae of six California fishes. Calif. Fish Game, Fish Bull. 56:1-50.

53. Bulkley, R. V. 1966. Catch of the 1965 tidewater cutthroat sport fishery and notes on the life history of the coastal cutthroat in the Siuslaw River, Oregon. Fish Res. Rept. No. 4, Oregon State Game Comm., Portland, 29 p.

54. Burt, W. V., and W. B. McAlister. 1959. Recent studies in the hydrography of Oregon estuaries. Fish Comm. Oregon Res. Briefs 7(1):14-27.

55. Butler, J. L., H. G. Moser, G. S. Hageman, and L. E. Nordgren. 1982. Developmental stages of three California sea basses (*Paralabrax*, Pisces, Serranidae). Calif. Coop. Ocean. Fish. Invest. 23:252-268.

56. Cahn, A. R. 1950. Oyster culture in Japan. Fish. Leafl. 383, U.S. Fish Wildl. Serv., 80 p.

57. Cahn, A. R. 1951. Clam culture in Japan. Fish. Leafl. 399, U.S. Fish Wildl. Serv., 103 p.

58. Cailliet, G. M., B. Antrim, D. Ambrose, S. Pace, and M. Stevenson. 1977. Species composition, abundance and ecological studies of fishes, larval fishes, and zooplankton in Elkhorn Slough. *In* Ecologic and hydrographic studies of Elkhorn Slough, Moss Landing Harbor and nearshore coastal waters, p. 216-386. Moss Landing Marine Lab., Moss Landing, CA.

59. Calhoun, A. J. 1952. Annual migrations of California striped bass. Calif. Fish Game 38(2):391-403.

60. California Department of Fish and Game. 1987a. Delta outflow effects on the abundance and distribution of San Francisco Bay fish and invertebrates, 1980-1985. Exhibit 60, entered by the Calif. Dept. Fish Game for the State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding on the San Francisco Bay/Sacramento-San Joaquin Delta. Calif. Dept. Fish Game, Stockton, 345 p.

61. California Department of Fish and Game. 1987b. Factors affecting striped bass abundance in the Sacramento-San Joaquin River system. Exhibit 25, entered by the Calif. Dept. Fish Game for the State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding on the San Francisco Bay/Sacramento-San Joaquin Delta. Calif. Dept. Fish Game, Stockton, 149 p. plus appendices.

62. Carlisle, J. G., Jr. 1969. Results of a six-year trawl study in an area of heavy waste discharge: Santa Monica Bay, California. Calif. Fish Game 55(1):26-46.

63. Carlson, B. L. K. 1981. Effects of temperature, salinity, feeding, substrate, and storage on the setting and survival of commercially-reared eyed larvae of the Pacific oyster, *Crassostrea gigas*. M.S. thesis, Oregon State Univ., Corvallis, 90 p.

64. Carpelan, L. H. 1955. Tolerance of the San Francisco topsmelt, *Atherinops affinis affinis*, to conditions in salt-producing ponds bordering San Francisco Bay. Calif. Fish Game 41(4):297-284.

65. Carter, W. R., III. 1965. Racial variations of the arrow goby, *Clevlandia ios* (Jordan and Gilbert) 1882 in Puget Sound and on the coast of Washington state. M.S. thesis, Univ. Wash., Seattle, 88 p.

66. Chamberlain, D. W. 1973. Results of fourteen benthic trawls conducted in the outer Los Angeles - Long Beach Harbor, California, May 24, 1972. *In* D. F. Soule and M. Oguri (editors), Marine studies of San Pedro Bay, Part II, Biological investigations June, 1973, p. 107-146. Allan Hancock Found., Univ. South. Calif., Los Angeles.

67. Chamberlain, R. H. 1988. Fish use of a mitigation salt marsh. M.S. Thesis, Humboldt State Univ., Arcata, CA, 122 p.

68. Chapman, D. W. 1958. Studies on the life history of Alsea River steelhead. J. Wildl. Man. 22(2):123-134.

69. Chapman, G. A. 1963. Mission Bay, a review of previous studies and the status of the sportfishery. Calif. Fish Game 49(1):30-43.

70. Chaw, M. P. 1981. Evaluation of mussel spat collectors. M.S. thesis, Humboldt State Univ., Arcata, CA, 44 p.

71. Cheney, D. P., and T. F. Mumford, Jr. 1986. Shellfish and seaweed harvests of Puget Sound. Wash. Sea Grant, Univ. Wash., Seattle, 164 p.

72. Cheney, E. D., and L. E. Perry. 1976. Columbia Basin salmon and steelhead analysis. Summ. Rept., Pacific Northwest Regional Comm., Vancouver, WA, 74 p.

73. Chew, K. K. 1989. Manila clam biology and fishery development in western North America. *In* J. J. Manzi and M. Castagna (editors), Clam mariculture in North America, p. 243-261. Elsevier, New York.

74. Chew, K. K., and A. P. Ma. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) — common littleneck clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.78). U.S. Army Corps of Eng., TR EL-82-4, 22 p.

75. Christensen, F. W. 1984. Intertidal growth response of *Mytilus edulis* (Linnaeus) in Humboldt Bay, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 35 p.

76. Chung, A. W., and W. G. Pearcy. 1986. The utilization of Netarts Bay by juvenile chum salmon - 1986. Oregon State Univ., Sea Grant Coll. Prog., Corvallis, 50 p.

77. CH2M Hill. 1974. A comparative study of fish and shellfish collected in Grays Harbor and Willapa Bay, February 1974. Final Rept. to ITT Rayonier Inc., CH2M Hill, Bellevue, WA, 27 p.

78. CH2M Hill. 1985. Klamath River basin fisheries resource plan. Rept. to U.S. Dept. Inter., CH2M Hill, Bellevue, WA, various pagination.

79. Clark, F. N. 1929. The life history of the California jack smelt, *Atherinopsis californiensis*. Calif. Fish Game, Fish Bull. 16:1-22.

80. Clark, P. C. 1973. Aspects of the life history of *Tresus nuttalli* in Elkhorn Slough. M.A. thesis, Calif. State Univ., Hayward, 26 p.

81. Clark, P., J. Nybakken, and L. Laurent. 1975. Aspects of the life history of *Tresus nuttali* in Elkhorn Slough. Calif. Fish Game 61(4):215-227.

82. Coley, T. C., G. T. McCabe, Jr., R. L. Emmett, and R. J. McConnell. 1986. Juvenile lingcod outer harbor field survey, Grays Harbor navigation improvement project. NWAFC Proc. Rept., 43 p., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

83. Collier, P. C. 1983. Movement and growth of post-larval Dungeness crabs, *Cancer magister*, in the San Francisco Bay area. *In* P. W. Wild and R. N. Tasto (editors), Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister* with emphasis on the central California fishery resource, p. 125-133. Calif. Fish Game, Fish Bull. 172.

84. Congleton, J. L., S. K. Davis, and S. R. Foley. 1981. Distribution, abundance, and outmigration timing of chum and chinook salmon fry in the Skagit salt marsh. *In* E. L. Brannon and E. O. Salo (editors), Salmon and trout migratory behavior symposium, p. 153-163. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle.

85. Conley, R. L. 1977. Distribution, relative abundance, and feeding habits of marine and juvenile anadromous fishes of Everett Bay, Washington. M.S. thesis, Univ. Wash., Seattle, 57 p.

86. Cooper, K. 1983. Larval habitat selection and recruitment of *Mytilus edulis* L. by chemical and tactile clues. M.S. thesis, Humboldt State Univ., Arcata, CA, 35 p.

87. Cramer, S. P. 1987. Abundance of Rogue River fall chinook salmon. Prog. Rept., Oregon Dept. Fish Wildl., Portland, 16 p.

88. Cramer, S. P., T. D. Satterthwaite, R. B. Boyce, and B. P. McPherson. 1985. Impacts of Lost Creek Dam on the biology of anadromous salmonids in the Rogue River. Vol. 1. Lost Creek Dam fisheries evaluation. Phase I, Compl. Rept., Oregon Dept. Fish Wildl., Corvallis, 271 p.

89. Cross, J. N. 1986. Seasonal changes in DDT and PCB concentrations in white croaker are related to the reproductive cycle. Coast. Water Res. News 1(2):2.

90. Cummings, T. E., and R. L. Berry. 1974. Some observations on fish distribution in Tillamook Bay, Oregon, with notes on shellfish, temperature, and physical characteristics. Info Rept. 74-1, Oregon Fish Comm., Portland, 29 p.

91. Cummings, E., and E. Schwartz. 1971. Fish in Coos Bay, Oregon, with comments on distribution, temperature, and salinity of the estuary. Info. Rept. 70-11, Oregon Fish Comm., Portland, 22 p.

92. Dawley, E. M., R. D. Ledgerwood, and A. L. Jensen. 1985. Beach - purse seine sampling of juvenile salmonids in the Columbia River estuary and ocean plume, 1977-1983. Volume 1. Procedures, sampling effort, and catch data. NOAA Tech. Memo. NMFS F/NWC-74, 260 p.

93. Day, M. E., C. A. Coumes, P. L. Striplin, and D. Grosse. 1986. Review and annotated bibliography of juvenile lingcod and flatfish populations inhabiting Grays Harbor with reference to potential adverse impacts caused by dredging. Final Rept. to U.S. Army Corps Eng. by Evans-Hamilton, Inc., and Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, WA, 140 p.

94. DeGeorges, A. 1972. Feasibility of artificial reefs in intertidal waters. M.S. thesis, Humboldt State Univ., Arcata, CA, 102 p.

95. DeLacy, A. C., B. S. Miller, S. F. Borton. 1972. Checklist of Puget Sound Fishes. Wash. Sea Grant, Divi. Mar. Res., Univ. Wash., Seattle, 43 p.

96. Deschamps, G., S. G. Wright, and R. E. Watson. 1971. Fish migration and distribution in the lower Chehalis River and upper Grays Harbor. *In* Grays Harbor cooperative water quality study 1964-1966, p. 1-55. Tech. Rept. No. 7, Wash. Dept. Fish., Olympia.

97. de Wit, L. A. 1975. Changes in the species composition of sharks in south San Francisco Bay. Calif. Fish Game 61(2):106-111.

98. DeWitt, J. W. 1954. A survey of the coast cutthroat trout, *Salmo clarki clarki* Richardson, in California. Calif. Fish Game 40:329-335.

99. Dexter, D. M. 1983. Soft bottom infaunal communities in Mission Bay. Calif. Fish Game 69(1):5-17.

100. Dinnel, P. A., D. Armstrong, B. Miller, and R. Donnelly. 1986. U.S. Navy homeport disposal site investigations summer cruise report. Fish. Res. Inst., School Fish., Univ. Wash., Seattle, FRI-UW-8803, 123 p.

101. Dinnell, P. A., R. O. McMillan, D. A. Armstrong, T. C. Wainwright, A. J. Whiley, R. Burge, and R. Baumgarner. 1987. Padilla Bay Dungeness crab, *Cancer magister*, habitat study. Fish. Res. Inst., School Fish., Univ. Wash., Seattle, 78 p.

102. Dixon, R. L., and W. J. Eckmayer. 1975. A checklist of the Elasmobranchs and Teleosts in the outer harbor of Anaheim Bay. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 175-184. Calif. Fish Game, Fish Bull. 165.

103. Donnelly, R., B. Miller, R. Lauth, and J. Shriner. 1984. Fish ecology. Section 7, Volume VI. *In* Q. J. Stober and K. K. Chew (principal investigators), Renton sewage treatment plant project: Seahurst baseline study, 276 p. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle.

104. Dryfoos, R. L. 1965. The ecology and life history of the longfin smelt in Lake Washington. Ph.D. thesis. Univ. Wash., Seattle, 159 p.

105. Dubsky, P. A. 1974. Movement patterns and activity levels of fishes in Morro Bay, California as determined by ultrasonic tagging. M.S. thesis, Calif. Polytech. State Univ., San Luis Obispo, 51 p.

106. Dunn, P. L. 1981. Migration behavior and holding habitat of adult summer steelhead in Wooler Creek, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 83 p.

107. Durkin, J. T. 1982. Migration characteristics of coho salmon (*Oncorhynchus kisutch*) smolts in the Columbia River and its estuary. *In* V. S. Kennedy (editor), Estuarine comparisons, p. 365-376. Academic Press, New York.

108. Durkin, J. T., and S. J. Lipovsky. 1977. Aquatic disposal field investigations Columbia River disposal site, Oregon. Appendix E: Demersal fish and decapod shellfish studies. Tech. Rept. D-77-30, U.S. Army Corps Eng., Waterways Exp. Sta., Vicksburg, MS, 184 p.

109. Ebert, D. A. 1986. Observations of the Elasmobranch assemblage of San Francisco Bay. Calif. Fish Game 72(4):244-249.

110. Ecological Analysts, Inc. 1983. Moss Landing power plant cooling water intake structures 316(b) demonstration. Rept. to Pacific Gas and Electric Co., Ecol. Analysts, Inc., Lafayette, CA, various pagination.

111. Edmands, F. A. 1983. The diel distribution and transport of ichthyoplankton collected by stationary nets in Newport Bay, California, July 1979. M.S. Thesis, Calif. State Univ., Fullerton, 112 p.

112. Edwards, R. L. 1984. The reproductive and percentage solids cycles of *Mytilus edulis* and *Mytilus californianus* in Humboldt County, California. M.S. Thesis, Humboldt State Univ., Arcata, CA, 57 p.

113. Eissinger, R. A. 1970. Density distributions of economically important species of clams in Elkhorn Slough, Monterey Bay. Unpubl. Rept., 25 p. Moss Landing Marine Lab, Moss Landing, CA.

114. Eldridge, M. B. 1975. Early larvae of the diamond turbot, *Hypsopsetta guttulata*. Calif. Fish Game 61(1):26-34.

115. Eldridge, M. B. 1977. Factors influencing distribution of fish eggs and larvae over eight 24-hr samplings in Richardson Bay, California. Calif. Fish Game 63(2):101-116.

116. Eldridge, M. B., and C. F. Bryan. 1972. Larval fish survey of Humboldt Bay, California. NOAA Tech. Rept. NMFS SSRF-665, 8 p.

117. Eldridge, M. B., and W. M. Kaill. 1973. San Francisco Bay area's herring resource - a colorful past and a controversial future. Mar. Fish. Rev. 25:25-31.

118. Environmental Protection Agency. 1971. Columbia River thermal effects study. Volume 1: biological effects studies. U.S. Environ. Prot. Agency, U.S. Atomic Energy Comm., and Natl. Mar. Fish. Serv., 102 p.

119. Eschmeyer, W. N., E. S. Herald, and H. Hammann. 1983. A field guide to Pacific Coast fishes of North America. Houghton Mifflin Company, Boston, MA, 336 p.

120. Everest, F. H. 1973. Ecology and management of summer steelhead in the Rogue River. Fish. Res. Rept. No. 7. Oregon State Game Comm., Corvallis, 48 p.

121. Farley, J. C. 1966. Striped bass, *Roccus saxatilis*, spawning in the Sacramento-San Joaquin River system during 1963 and 1964. In J. L. Turner and D. W. Kelley (editors), Ecological studies of the Sacramento-San Joaquin delta. Part II, p. 28-43. Calif. Dept. Fish Game, Fish Bull. 136.

122. Fay, R. C., J. A. Vallee, and P. Brophy. 1978. An analysis of fish catches obtained with an otter trawl in Santa Monica Bay, 1969-73. Calif. Fish Game 64(2):104-116.

123. Feder, H. M., C. H. Turner, and C. Limbaugh. 1974. Observations on fishes associated with kelp beds in southern California. Calif. Fish Game, Fish Bull. 160:1-144.

124. Feller, R. J., and V. W. Kaczynski. 1975. Size selective predation by juvenile chum salmon (*Oncorhynchus keta*) on epibenthic prey in Puget Sound. J. Fish. Res. Board Can. 32:1419-1429.

125. Fierstine, H. L., K. F. Kline, and G., R. Garman. 1973. Fishes collected in Morro Bay, California between January 1968 and December 1970. Calif. Fish Game 59(1):73-88.

126. Filice, F. P. 1958. Invertebrates from the estuarine portion of San Francisco Bay and some factors influencing their distributions. Wasmann J. Biol. 16(2):159-211.

127. Fish Commission of Oregon and Oregon State Game Commission. 1946. The Umpqua River study. Fish Comm. of Oregon and Oregon State Game Comm., Portland, 74 p.

128. Fitch, J. E. 1953. Common marine bivalves of California. Calif. Fish Game, Fish Bull. 90:1-102.

129. Ford, R. F. 1968. Marine organisms of south San Diego Bay and the ecological effects of power station cooling water discharge. Rept. to San Diego Gas and Electric Co., Dept. of Biol., San Diego State Coll., San Diego, CA, 245 p.

130. Ford, R. F., R. W. Chambers, and R. L. Chambers. 1975. Biological studies and thermal distribution at the Station B power plant September 1972 - August 1973. Rept. to San Diego Gas and Elec. Co., Environ. Eng. Lab., San Diego, CA, 409 p.

131. Forsberg, B. O., J. A. Johnson, and S. M. Klug. 1977. Identification, distribution, and notes on food habits of fish and shellfish in Tillamook Bay, Oregon. Fed. Aid Prog. Rept., Fish., Oregon Dept. Fish Wildl., Corvallis, 117 p.

132. Fox, D. S., S. Bell, W. Nehlsen, and J. Damron. 1984. The Columbia River estuary: atlas of physical and biological characteristics. Columbia River Estuary Data Development Program, Columbia River Estuary Study Taskforce, Astoria, OR. 87 p.

133. Fresh, K. L. 1979. Distribution and abundance of fishes occurring in the nearshore surface water of northern Puget Sound, Washington. M.S. thesis, Univ. Wash., Seattle, 120 p.

134. Fresh, K. L., D. Rabin, C. Simenstad, E. O. Salo, K. Garrison, and C. Matheson. 1979. Fish ecology studies in the Nisqually reach area of southern Puget Sound, Washington. Final Rept. to Weyerhaeuser Company, FRI-UW-7904. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, 229 p.

135. Frey, H. W. (editor). 1971. California's living marine resources and their utilization. Calif. Dept. Fish Game, Sacramento, 148 p.

136. Freymond, W., and S. Foley. 1985. Wild steelhead: spawning escapements for Boldt case area rivers. Wash. Dept. Game, Olympia, 204 p.

137. Fronk, R. H. 1969. Biology of *Atherinops affinis littoralis* Hubbs in Newport Bay. M.S. Thesis, Univ. Calif., Irvine, 106 p.

138. Fry, D. H., Jr. 1979. Anadromous fishes of California. Calif. Dept. of Fish and Game, Sacramento, 112 p.

139. Galbreath, J. L. 1966. Timing of tributary races of chinook salmon through the lower Columbia River based on analysis of tag recoveries. Fish Comm. Oregon, Res. Briefs 12(1):58-80.

140. Ganssle, D. 1966. Fishes and decapods of the San Pablo and Suisun Bays. *In* D. W. Kelley (compiler), Ecological studies of the Sacramento-San Joaquin estuary, Part I, Zooplankton, zoobenthos, and fishes of San Pablo and Suisun Bays, zooplankton and zoobenthos of the delta, p. 64-94. Calif. Fish Game, Fish Bull. 133.

141. Garrison, K. J., and B. S. Miller. 1982. Review of the early life history of Puget Sound fishes. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, FRI-UW-8216, 729 p.

142. Garth, J. S., and D. P. Abbott. 1980. Brachyura: the true crabs. *In* R. H. Morris, D. P. Abbott, and E. C. Haderlie (editors), Intertidal invertebrates of California, p. 594-630, Stanford Univ. Press, Stanford, CA.

143. Gaumer, T., D. Demory, and L. Osis. 1973a. 1971 Alsea River estuary resource use study. Fish Comm. Oregon, Portland, 28 p.

144. Gaumer, T., D. Demory, and L. Osis. 1973b. 1971 Chetco and Rogue River estuaries resource use study. Fish Comm. Oregon, Portland, 28 p.

145. Gaumer, T., D. Demory, and L. Osis. 1973c. 1971 Coos Bay resource use study. Fish Comm. Oregon, Portland, 28 p.

146. Gaumer, T., D. Demory, and L. Osis. 1973d. 1971 Nehalem River estuary resource use study. Fish Comm. Oregon, Portland, 27 p.

147. Gaumer, T., D. Demory, and L. Osis. 1973e. 1971 Siletz River estuary resource use study. Fish Comm. Oregon, Portland, 27 p.

148. Gaumer, T., D. Demory, and L. Osis,. 1973f. 1971 Tillamook Bay resource use study. Fish Comm. Oregon, Portland, 28 p.

149. Gaumer, T., D. Demory, and L. Osis. 1973g. 1970-71 Umpqua River estuary resource use study. Fish. Comm. Oregon, Portland, 27 p.

150. Gaumer, T., D. Demory, and L. Osis. 1974a. 1971 Netarts Bay estuary resource use study. Fish Comm. Oregon, Portland, 27 p.

151. Gaumer, T., D. Demory, and L. Osis. 1974b 1970-71 Siuslaw River estuary resource use study. Fish. Comm. Oregon, Portland, 28 p.

152. Gaumer, T., D. Demory, L. Osis, and C. Walters. 1974c. 1970-71 Yaquina Bay resource use

study. Fish. Comm. Oregon, Portland, 32 p.

153. Gerdes, G. L., E. R. J. Primbs, and B. B. Browning. 1974. Natural resources of Morro Bay, their status and future. Coast. Wetland Ser. No. 8. Calif. Dept. Fish Game, Sacramento, 103 p. plus appendices.

154. Giger, R. D. 1972a. Some estuarine factors influencing ascent of anadromous cutthroat trout in Oregon. *In* Proceedings 2nd annual conference of estuaries of the Pacific Northwest, p.18-29. Oregon State Univ., Corvallis.

155. Giger, R. D. 1972b. Ecology and management of coastal cutthroat trout in Oregon. Fish Res. Rept. No. 6, Oregon State Game Comm., Portland, 61 p.

156. Glude, J. B. 1978. The clams genera *Mercenaria*, *Saxidomus*, *Protothaca*, *Tapes*, *Mya*, *Panope*, and *Spisula* : a literature review and analysis of the use of thermal effluent in the culture of clams. Unpubl. rept., 74 p. Humboldt State Univ., Arcata, CA.

157. Goldberg, S. R. 1976. Seasonal spawning cycles of the Sciaenid fishes *Genyonemus lineatus* and *Seriphus politus*. Fish. Bull., U.S. 74(4):983-984.

158. Gonyea, G. P. 1985. Abundance of Pacific herring in central and southern Puget Sound. Tech. Rept. No. 87, Wash. Dept. Fish., Olympia, 77 p.

159. Gonyea, G., S. Burton, and D. Penttila. 1982. Summary of 1982 herring recruitment studies in Puget Sound. Prog. Rept. No. 179, Wash. Dept. Fish., Olympia, 29 p.

160. Goodwin, L. 1973. Subtidal geoducks of Puget Sound. Tech. Rept. No. 13, Wash. Dept. Fish., Olympia, 64 p.

161. Goodwin, L. 1979. Puget Sound subtidal geoduck and hardshell clam survey data March 1978 to April 1979. Prog. Rept. 95, Wash. Dept. Fish., Olympia, 56 p.

162. Goodwin, L., and C. Jones. 1976. Standing crop estimates of soft-shell clams in Skagit and Port Susan Bays. Wash. Dept. Fish., Olympia, 35 p.

163. Goodwin, L., and W. Shawl. 1978. Puget Sound subtidal hardshell clam survey data. Prog. Rept. 44, Wash. Dept. Fish., Olympia, 92 p.

164. Gotshall, D. W. 1978. Relative abundance studies of Dungeness crabs, *Cancer magister*, in northern California. Calif. Fish Game 64(1):24-32.

165. Gotshall, D. W., G. H. Allen, and R. A. Barnhart. 1980. An annotated checklist of fishes from Humboldt Bay, California. Calif. Fish Game 66(4):220-232.

166. Graham, H. W., and H. Gary. 1945. Season of attachment and growth of sedentary marine organisms at Oakland, California. Ecol. 26:375-386.

167. Haaker, P. L. 1975. The biology of the California halibut, *Paralichthys californicus* (Ayres), in Anaheim Bay, California. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 137-151. Calif. Fish Game, Fish Bull. 165.

168. Haderlie, E. C., and D. P. Abbott. 1980. Bivalvia: the clams and allies. *In* R. H. Morris, D. P. Abbott, and E. C. Haderlie (editors), Intertidal invertebrates of California, p. 355-411. Stanford Univ. Press, Stanford, CA.

169. Haertel, L., and C. Osterberg. 1967. Ecology of zooplankton, benthos, and fishes in the Columbia River estuary. Ecol. 50:962-978.

170. Hallock, R. J., R. F. Elwell, and D. H. Fry, Jr. 1970. Migrations of adult king salmon, *Oncorhynchus tshawytscha*, in the San Joaquin Delta. Calif. Fish Game, Fish Bull. 151:1-92.

171. Hammann, M. G. 1981. Utilization of the Columbia River estuary by American shad, *Alosa sapidissima* (Wilson). M.S. thesis, Oregon State Univ., Corvallis, 48 p.

172. Hancock, D. R., T. F. Gaumer, G. B. Willeke, G. P. Robart and J. Flynn. 1979. Subtidal clam populations: distribution, abundance, and ecology. Publ. ORESU-T-79-002. Oregon State Univ, Sea Grant Coll. Prog., Corvallis, 243 p.

173. Harbors Environmental Projects. 1976. Environmental investigations and analyses; Los Angeles-Long Beach Harbors 1973-1976. Final Rept. to U.S. Army Corps of Eng., Los Angeles Dist. Harbors Env. Proj., Inst. Mar. Coast. Stud., Allan Hancock Found., Univ. South. Calif., Los Angeles, 737 p.

174. Hardwick, J. E. 1973. Biomass estimates of spawning herring, *Clupea harengus pallasi*, herring eggs, and associated vegetation in Tomales Bay. Calif. Fish Game 59(1):36-61.

175. Hatfield, S. E. 1985. Seasonal and interannual variation in distribution and population abundance of shrimp *Crangon franciscorum* in San Francisco Bay. Hydrobiolgia 129:199-210.

176. Heath, K. L. 1980. Comparative life histories of two species of anchovies, *Anchoa delicatissima* and *A. compressa* (F. Engraulidae) from Newport Bay, California. M.A. thesis, Calif. State Univ., Fullerton, 71 p.

177. Hedgepeth, J. W, and S. Obrebski. 1981. Willapa Bay: a historical perspective and a rationale for research. Off. Biol. Serv., U.S. Fish Wildl. Serv., Washington, D.C., FWS/OBS-81/03, 51 p.

178. Herald, E. S., and W. E. Ripley. 1951. The relative abundance of sharks and bat stingrays in San Francisco Bay. Calif. Fish Game 37(3):315-329.

179. Hines, A. H. 1979. Effects of a thermal discharge on reproductive cycles in *Mytilus edulis* and *Mytilus californianus*. Fish. Bull., U.S. 77(2):498-503.

180. Hoeman, J. C. 1982. Distribution and abundance of benthic fish in Grays Harbor. *In* D. A. Armstrong, B. G. Stevens, and J. C. Hoeman (authors), Distribution and abundance of Dungeness crab and *Crangon* shrimp and dredging related mortality on invertebrates and fish in Grays Harbor, Washington, p.154-177. Rept. to Seattle District, U.S. Army Corps Eng., Seattle, WA, by School Fish., Univ. Wash, Seattle.

181. Hoeman, J. C., and D. A. Armstrong. 1982. Distribution and abundance of three species of crangonid shrimp in Grays Harbor. *In* D. A. Armstrong, B. G. Stevens, and J. C. Hoeman, (authors), Distribution and abundance of Dungeness crab and *Crangon* shrimp and dredging related mortality on invertebrates and fish in Grays Harbor, Washington, p. 225-267. Rept. to Seattle District, U.S. Army Corps Engineers, Seattle, WA, by School Fish., Univ. Wash, Seattle.

182. Hoffman, C. J. 1981. Associations between the arrow goby *Clevelandia ios* (Jordan and Gilbert) and the ghost shrimp *Callianassa californiensis* Dana in natural and artificial burrows. Pac. Sci. 35(3):211-216.

183. Hoffman, R. S. 1986. Fishery utilization of eelgrass (*Zostera marina*) beds and non-vegetated shallow water areas in San Diego Bay. Admin. Rept. SWR-89-4, NOAA, Natl. Mar. Fish. Serv., La Jolla, CA, 29 p.

184. Holland, D. A., and K. K. Chew. 1974. Reproductive cycle of the Manila clam (*Venerupis japonica*), from Hood Canal, Washington. Proc. Natl. Shellfish. Assoc. 64:53-58.

185. Horn, M. H. 1974. Fishes. *In* A summary of knowledge of the southern California coastal zone and offshore areas, Chapter 11. South. Calif. Ocean Stud. Consort., Fullerton, CA. 124 p.

186. Horn, M. H. 1977. Fishes. *In* Draft environmental impact report, downtown marina, city of Long Beach, p. 124-223. South. Calif. Ocean Stud. Consort., Fullerton, CA.

187. Horn, M. H. 1980. Diel and seasonal variation in abundance and diversity of shallow-water fish populations in Morro Bay, California. Fish. Bull., U.S. 78(3):759-770.

188. Horn, M. H., and L. G. Allen. 1976. Numbers of species and faunal resemblance of marine fishes in California bays and estuaries. Bull South. Calif. Acad. Sci. 75(2):159-170.

189. Horn, M. H., and L. G. Allen. 1981a. A review and synthesis of ichthyofaunal studies in the vicinity of Los Angeles and Long Beach Harbors, Los Angeles County, California. Final Rept. to U.S. Fish Wildl. Serv., Dept. Biol. Sci., Calif. State Univ., Fullerton, 96 p.

190. Horn, M. H., and L. G. Allen. 1981b. Ecology of fishes in upper Newport Bay, California: seasonal dynamics and community structure. Mar. Res. Tech. Rept. No. 45, Calif. Dept. Fish Game, Long Beach, 102 p.

191. Horn, M. H., L. G. Allen, and F. D. Hagner. 1984. Ecological status of striped bass, *Morone saxatilis*, in upper Newport Bay, California. Calif. Fish Game 70(3):180-182.

192. Horn, M. H., and F. D. Hagner, 1982. Fish and ichthyoplankton. *In* Baseline biological survey for the environmental impact report for the Terminal Island dry bulk handling terminal and related landfills in outer Los Angeles Harbor, California, p. 1-43. Draft Rept. to Los Angeles Harbor Dept., South. Calif. Ocean Stud. Consort., Fullerton, CA.

193. Hostick, G. A. 1975. Numbers of fish captured in beach seine hauls in Coos River estuary, Oregon, June through September 1970. Info. Rept. 74-11, Fish Comm. of Oregon, Portland, 22 p.

194. Houghton, J. P. 1973. Intertidal ecology. In Q. J. Stober, and E. O. Salo (editors), Ecological studies of the proposed Kiket Island nuclear power site, p. 119-257. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, FRI-UW-7304.

195. Hubbs, C. L. 1925. Racial and seasonal variation in the Pacific herring, California sardine and California anchovy. Calif. Fish Game, Fish Bull. 8:1-23.

196. Huppert, D. D., A. D. MacCall, G. D. Stauffer, K. R. Parker, J. A. McMillan, and H. W. Frey. 1980. California's northern anchovy fishery: biological and economic basis for fishery management. NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-1, 121 p. plus appendices.

197. Hutchinson, J. M. 1979. Seasonal distribution of fishes in Siuslaw Bay. Oregon Dept. Fish Wildl. Corvallis, 55 p.

198. Israel, H. R. 1936. A contribution toward the life histories of two California shrimps, *Crago franciscorum* (Stimpson) and *Crago nigricauda* (Stimpson). Calif. Fish Game, Fish Bull. 46:1-28.

199. Jay, C. W. 1985. Life history relationships between the parasitic isopod *Argeia pugettensis* (Epicarea: Bopyridae) and its host shrimp *Crangon franciscorum* (Caridea: Crangonidae). M.S. thesis, Humboldt State Univ., Arcata, CA, 63 p.

200. Johnson, J., D. P. Liscia, and D. M. Anderson. 1986. The seasonal occurrence and distribution of fish in the Umpqua estuary April 1977 through January 1986. Info. Rept. 86-6, Oregon Dept. Fish Wildl., Corvallis, 10 p.

201. Johnson, K. W. 1979. The relationship between *Mytilus edulis* larvae in the plankton and settlement for Holmes Harbor, Washington. M.S. Thesis, Univ. Wash., Seattle, 45 p.

202. Johnston, J. M. 1981. Life histories of anadromous cutthroat with emphasis on migratory behavior. *In* E. L. Brannon and E. O. Salo (editors), Salmon and trout migratory behavior symposium, p. 123-127. Univ. Wash., Seattle.

203. Jones, A. C. 1962. The biology of the euryhaline fish *Leptocottus armatus armatus* Girard. Univ. Calif. Publ. Zool. 67(4):321-368.

204. Jones, K. K., and D. L. Bottom. 1984. Zooplankton and larval fishes of the Columbia River estuary. Columbia River Estuary Data Development Program, Columbia River Estuary Study Taskforce, Astoria, OR, 36 p. plus appendices.

205. Jones and Stokes Associates, Inc. 1977. San Francisco Bay shellfish: an assessment of the potential for commercial and recreational harvesting. Jones and Stokes Assoc., Inc., Sacramento, CA, 138 p.

206. Jow, T. 1969. Results of English sole tagging off California. Pac. Mar. Fish. Comm., Bull. 7:15-33.

207. Kelley, D. W. 1968. American shad. *In* Fish and wildlife resources of San Francisco Bay and delta: description, environmental requirements, problems, opportunities and the future, p. 239-251. Prepared. for San Francisco Bay-Delta water quality control program, Calif. Dept. Fish Game, Sacramento.

208. Kelly, J. L., and D. W. Behrens. 1982. Fish composition of tri-net trawls in Morro Bay. Pacific Gas and Electric Co., Dept. of Eng. Res., Rept. 026.22-80.2, 15 p. plus appendices.

209. King, J., M. Mayer, J. Oliver, B. Ramer, D. Small, and M. Silberstein. 1986. Monitoring ecological changes in the new south marsh on Elkhorn Slough National Estuarine Sanctuary. NOAA Tech. Rept. Ser. OCRM/SPD, Wash., D.C., 74 p.

210. Kinnetic Laboratories Incorporated and Larry Walker Associates. 1987. South Bay dischargers authority water quality monitoring program. Final Monitoring Rept. (December 1981-November 1986), Kinnetic Lab., Santa Cruz, CA, 467 p.

211. Kjelson, M. A., P. F. Raquiel, and F. W. Fisher. 1982. Life history of fall-run juvenile chinook salmon, *Oncorhynchus tshawytscha*, in the Sacramento-San Joaquin estuary, California. *In* V. S. Kennedy (editor), Estuarine comparisons, p. 393-411. Academic Press, New York.

212. Klingbeil, R. A., R. D. Sandell, and A. W. Wells. 1975. An annotated checklist of the Elasmobranchs and Teleosts of Anaheim Bay. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 74-90. Calif. Fish Game, Fish Bull. 165.

213. Kohlhorst, D. W. 1976. Sturgeon spawning in the Sacramento River in 1973, as determined by distribution of larvae. Calif. Fish Game 62(1):32-40.

214. Kosner, W. D., and R. A. Barnhart. 1972. Characteristics of the fall-run steelhead trout (*Salmo gairdneri gairdneri*) of the Klamath River system with emphasis on the half-pounder. Calif. Fish Game

58(3): 204-220.

215. Kozloff, E. N. 1987. Marine invertebrates of the Pacific Northwest. Univ. Wash. Press, Seattle, WA, 511 p.

216. Kramer, S. H., and J. R. Hunter. 1987. Southern California wetland/shallow water habitat investigation. Ann. Rept., Nat. Mar. Fish. Serv., La Jolla, CA, 12 p.

217. Kreag, R. A. 1979. Natural resources of Netarts estuary. Oregon Dept. Fish Wildl., Corvallis, 45 p.

218. Krygier, E. E. 1973. Distribution and reproductive biology of *Crangon franciscorum* (Stimpson) and *Crangon nigricauda* (Stimpson), in Yaquina Bay, Oregon. M.S. thesis, Oregon State Univ., Corvallis, 57 p.

219. Krygier, E. E. and H. F. Horton. 1975. Distribution, reproduction, and growth of *Crangon nigricauda* and *Crangon franciscorum* in Yaquina Bay, Oregon. Northw. Sci. 49(4):216-240.

220. Kukowski, G. E. 1972. A checklist of the fishes of the Monterey Bay area including Elkhorn Slough, the San Lorenzo, Pajaro and Salinas Rivers. Contrib. Moss Landing Marine Lab., No. 26, Tech. Publ. 72-2, Moss Landing Marine Lab., Moss Landing, CA, 69 p.

221. Kukowski, G. E. 1973. Results of the Sea Grant fishes sampling program for the 1971-1972 season. Contrib. Moss Landing Marine Lab., No. 37, Moss Landing Marine Lab., Moss Landing, CA, 46 p.

222. Lane, E. D. 1975. Quantitative aspects of the life history of the diamond turbot, *Hypsopsetta guttulata* (Girard), in Anaheim Bay. *In* E. D. Lane and C. W. Hill. (editors), 1975. The marine resources of Anaheim Bay, p. 153-173. Calif. Fish Game, Fish Bull. 165.

223. Lane, E. D., and C. W. Hill. (editors). 1975. The marine resources of Anaheim Bay. Calif. Fish Game, Fish Bull. 165, 195 p.

224. LaRiviere, M. G., D. D. Jessup, and S. B. Mathews. 1981. Lingcod, *Ophiodon elongatus*, spawning and nesting in San Juan Channel, Washington. Calif. Fish Game 67(4):231-239.

225. Larson, R. J., and E. E. DeMartini. 1984. Abundance and vertical distribution of fishes in a cobble-bottom kelp forest off San Onofre, California. Fish. Bull., U.S. 82(1):37-53.

226. Lasker, R., and P. E. Smith. 1977. Estimation of the effects of environmental variations on the eggs and larvae of the northern anchovy. Calif. Coop. Ocean. Fish. Invest. 19:128-137.

227. Lauman, J. E., A. K. Smith, and K. E. Thompson. 1972. Supplement to the fish and wildlife resources of the north coast basin, Oregon, and their water requirements, April 1968. Oregon State Game Comm., Portland, 52 p.

228. Lauman, J. E., K. E. Thompson, and J. D. Fortune, Jr. 1972. Fish and wildlife resources of the Umpqua Basin, Oregon, and their water requirements. Oregon State Game Comm., Portland, 127 p.

229. Laurent, L. L. 1971. The spawning cycle and juvenile growth rate of the gaper clam, *Tresus nuttalli*, of Elkhorn Slough, California. M.A. thesis, San Francisco State Coll., San Francisco, CA. 55 p.

230. Lavenberg, R. J., G. E. McGowen, A. E. Jahn, J. H. Petersen, and T. C. Sciarrotta. 1986. Abundance of southern California nearshore ichthyoplankton: 1978-1984. Calif. Coop. Ocean. Fish. Invest. 27:53-64.

231. Leithiser, R. M. 1977. The seasonal abundance and distribution of larval fishes in Anaheim Bay, California. M.S. thesis, Calif. State Univ., Long Beach, 132 p.

232. Leithiser, R. M. 1981. Distribution and seasonal abundance of larval fishes in a pristine southern California salt marsh. Rapport P.-U. Reun. Cons. Int. Explor. Mer. 178:174-175.

233. Lichatowich, J. A., and J. T. Martin. 1977. Rogue basin evaluation program, adult salmonid and estuary studies. Prog. Rept., Oregon Dept. Fish Wildl., Corvallis, 36 p.

234. Lock, J. J. 1982. Juvenile and adult steelhead and sea-run cutthroat trout within the Columbia River estuary, 1980. Wash. Dept. Game, Olympia, 84 p.

235. Lockheed Ocean Science Laboratories. 1983. Distribution and abundance of fishes in central San Diego Bay, California: a study of fish habitat utilization. Rept. to Dept. Navy, Contract No. N62474-82-C-1068, San Diego, CA, 38 p. plus appendices.

236. Love, M. S., G. E. McGowen, W. Westphal, R. J. Lavenberg, and L. Martin. 1984. Aspects of the life

history and fishery of the white croaker, *Genyonemus lineatus* (Sciaenidae), off California. Fish. Bull., U.S. 82(1):179-198.

237. Love, M. S., J. S. Stephens, Jr., P. A. Morris, M. M. Singer, M. Sandhu, and T. C. Sciarrotta. 1986. Inshore soft substrata fishes in the southern California bight: an overview. Calif. Coop. Ocean. Fish. Invest. 27:84-104.

238. Lukas, G. 1973. Clam-abalone spawning and rearing. Compl. Rept., Fish Comm. Oregon, Portland, 19 p.

239. Lukas, J., and C. Carter. 1988. 1986 pounds and value of commercially caught fish and shellfish landed in Oregon. Oregon Dept. Fish Wildl., Portland, 83 p.

240. MacDonald, C. K. 1975. Notes on the family Gobiidae from Anaheim Bay. *In* E.D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 117-121. Calif. Fish Game, Fish Bull. 165.

241. MacGinitie, G. E. 1935. Ecological aspects of a California marine estuary. Am. Midl. Nat. 16(5):629-765.

242. Machell, J. R. 1968. The reproduction cycle of the clam, *Tresus capax* (Gould 1850), family Mactridae, in south Humboldt Bay, California. M.A. thesis. Humboldt State Univ., Arcata, CA, 28 p.

243. Machell, J. R., and J. D. DeMartini. 1971. An annual reproductive cycle of the gaper clam, *Tresus capax* (Gould), in south Humboldt Bay, California. Calif. Fish Game 57(4):274-282.

244. MacIntyre, J., S. R. Sparling, M. Faustini, T. L. Richards, R. Nakamura, and B. F. Putman. 1986. Resource inventory: Marine life: Cayucos State Beach, Morrow Strand State Beach, Atascadero State Beach, Morro Bay State Park, Montana De Oro State Park. Calif. Polytech. State Univ., San Luis Obispo, various pagination.

245. Marriage, L. D. 1954. The bay clams of Oregon: their economic importance, relative abundance, and general distribution. Cont. No. 20, Fish Comm. Oregon, Portland, 47 p.

246. Mayer, D. L. 1973. Subtidal ecology. *In* Q. J. Stober, and E. O. Salo (editors), Ecological studies of the proposed Kiket Island nuclear power site, p. 259-370. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, FRI-UW-7304.

247. McCabe, G. T., Jr., and T. C. Coley. 1985. Occurrence of topsmelt, *Atherinops affinis*, in the Columbia River estuary. J. Idaho Acad. Sci. 21(1/2):40-41.

248. McCabe, G. T., Jr., R. L. Emmett, T. C. Coley, and R. J. McConnell. 1986. Distribution, abundance, and size-class structure of Dungeness crabs in the Columbia River estuary. Proc. Rept., 57 p. Northwest and Alaska Fish. Cent., Nat. Mar. Fish. Serv., NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

249. McCabe, G. T., Jr., R. L. Emmett, T. C. Coley, W. D. Muir, and R. J. McConnell. 1984. Fish sampling in Cathlamet Bay, Oregon—1984. Unpubl. Rept., 49 p., Final Rept. to U.S. Army Corps Eng., Nat. Mar, Fish. Serv., Hammond, OR.

250. McCabe, G. T., Jr., R. L. Emmett, W. D. Muir, and T. H. Blahm. 1986. Utilization of the Columbia River estuary by subyearling chinook salmon. Northw. Sci. 60(2):113-124.

251. McCabe, G. T., Jr., W. D. Muir, R. L. Emmett, and J. T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River estuary. Fish. Bull., U.S. 81(4):815-826.

252. McDowell, K. M., and C. A. Simenstad. 1981. Distribution and abundance of English sole. *In* C. A. Simenstad and D. M. Eggers (preparers), Juvenile salmonid and baitfish distribution, abundance, and prey resources in selected areas of Grays Harbor, Washington, p. 61-84. Final Rept. to Seattle Dist., U.S. Army Corps Eng., Seattle, WA. (Contract # DACW67-80-C-0102).

253. McGie, A. M., and R. E. Mullen. 1979. Age, growth, and population trends of striped bass, *Morone saxatilis*, in Oregon. Info. Rept. Ser., Fish. No. 79-8, Oregon Dept. Fish Wildl., Corvallis, 57 p.

254. McGowan, M. F. 1986. Northern anchovy, *Engraulis mordax*, spawning in San Francisco Bay, California, 1978-79, relative to hydrography and zooplankton prey of adults and larvae. Fish. Bull., U.S. 84(4):879-894.

255. McGowen, G. E. 1977. Icthyoplankton populations in south San Diego Bay and related affects of an electricity generating station. M.S. Thesis, San Diego State Univ, San Diego, CA, 157 p.

256. McGowen, G. E. 1981. Composition, distribution, and seasonality of ichthyoplankton populations

near an electricity generating station in south San Diego Bay, California. Rapp. D.-V. Reun. Cons. Int. Explor. Mar. 178:112-114.

257. McPherson, B. P., and S. P. Cramer. 1981. Rogue basin fisheries evaluation program, juvenile salmonid studies. Prog. Rept., Oregon Dept. Fish Wildl., Corvallis, 177 p.

258. Merino, Jose-Maria. 1981. A study of the temperature tolerances of adult *Solen rosaccus* and *Tagelus californianus* in south San Diego Bay: the effects of power plant cooling water discharge. Ph.D. thesis, San Diego State Univ., San Diego, CA, 140 p.

259. Messersmith, J. 1966. Fishes collected in Carquinez Strait in 1961-1962. In D. W. Kelley (compiler), Ecological studies of the Sacramento-San Joaquin estuary, Part I, Zooplankton, zoobenthos, and fishes of San Pablo and Suisun Bays, zooplankton and zoobenthos of the delta, p. 57-63. Calif. Fish Game, Fish Bull. 133.

260. Miller, B. S., and S. F. Borton. 1980. Geographical distribution of Puget Sound fishes: maps and data source sheets. 3 Volumes. Wash. Sea Grant Prog. and Wash. State Dept. Ecol., Seattle, WA, various pagination.

261. Miller, B. S., C. A. Simenstad, J. N. Cross, K. L. Fresh, and S. N. Steinfort. 1980. Nearshore fish and macroinvertebrate assemblages along the Strait of Juan de Fuca including food habits of the common nearshore fish: final report of three years sampling, 1976-1979. U.S. Dept. Comm., and U.S. Environ. Prot. Agen., Washington, D.C., 211 p.

262. Miller, B. S., C. A. Simenstad, L. L. Moulton, K. L. Fresh, F. C. Funk, W. A. Karp, and S. F. Borton. 1977. Puget Sound baseline program nearshore fish survey. Final Rept. to Wash. Dept. Ecol., Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, 220 p.

263. Miller, D. J., and J. J. Geibel. 1973. Summary of blue rockfish and lingcod life histories; a reef ecology study; and giant kelp, *Macrocystis pyrifera*, experiments in Monterey Bay, California. Calif. Fish Game, Fish Bull. 158:1-137.

264. Miller, D. J., and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Fish Game, Fish Bull. 157, 235 p.

265. Miller, L. W. 1972. Migrations of sturgeon tagged in the Sacramento-San Joaquin estuary. Calif. Fish Game 58(2):102-106.

266. Mills, M. L., and F. Solomon. In press. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Tech. Rept. No. 79. Wash. Dept. Fish., Olympia, 55 p.

267. Misitano, D. A. 1970. Aspects of the early life history of English sole (*Parophrys vetulus*) in Humboldt Bay, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 54 p.

268. Misitano, D. A. 1976. Size and stage of development of larval English sole, *Parophrys vetulus*, at time of entry into Humboldt Bay. Calif. Fish Game 62(1):93-98.

269. Misitano, D. A. 1977. Species composition and relative abundance of larval and post-larval fishes in the Columbia River estuary, 1973. Fish. Bull., U.S. 75(1):218-222.

270. Monroe, G. W., F. Reynolds, B. M. Browning, and J. W. Speth. 1974. Natural resources of the Eel River delta. Coast. Wetl. Ser. No. 9, Calif. Fish and Game, Sacramento, 108 p.

271. Monroe, G. W., S. J. Thompson, P. G. Swartzell, B. M. Browning, and J. W. Speth. 1973. The natural resources of Humboldt Bay. Coast. Wetl. Ser. No. 6, Calif. Fish and Game, Sacramento, 160 p. plus appendices.

272. Moore, D. R., and D. J. Reish. 1969. Studies on the *Mytilus edulis* community in Alamitos Bay, California, IV: Seasonal variation in gametes from different regions in the bay. Veliger 11(3):250-255.

273. Moser, H. G., D. A. Ambrose, M. S. Busby, J. L. Butler, E. M. Sankknop, B. Y. Sumida, and E. G. Stevens. 1983. Description of early stages of white seabass, *Atractoscion nobilis*, with notes on distribution. Calif. Coop. Ocean. Fish. Invest. 24:182-193.

274. Moyle, P. B. 1976. Inland fishes of California. Univ. Calif. Press, Berkeley, 405 p.

275. Moyle, P. B., R. A. Daniels, B. Herbold, and D. M. Baltz. 1986. Patterns in distribution and abundance of a noncoevolved assemblage of estuarine fishes in California. Fish. Bull., U.S. 84(1):105-117.

276. Mullen, R. E. 1972. Ecology of shad and striped bass in coastal rivers and estuaries. Fish Comm. Oregon, Portland, 31 p.

277. Mullen, R. E., 1977. The occurrence and distribution of fish in the Umpqua River estuary, June

through October 1972. Info. Rept. 77-3, Oregon Dept. Fish Wildl., Corvallis, 39 p.

278. Myers, K. W. W. 1980. An investigation of the utilization of four study areas in Yaquina Bay, Oregon, by hatchery and wild juvenile salmonids. M.S. thesis, Oregon State Univ., Corvallis, 234 p.

279. National Marine Fisheries Service. 1981. Columbia River estuary data development program report, salmonid and non-salmonid fish. Unpubl. Rept., various pagination. Northwest and Alaska Fish. Cent., Nat. Mar. Fish. Serv., NOAA, P.O. Box 155, Hammond, OR, 97121.

280. Nicholas, J. W., and D. G. Hankin. 1988. Chinook salmon populations in Oregon coastal river basins: description of life histories and assessment of recent trends in run strengths. Info. Rept. 88-1, Oregon Dept. Fish Wildl., Corvallis, 359 p.

281. Nichols, F. H., and M. M. Pamatmat. 1988. The ecology of the soft-bottom benthos of San Francisco Bay: a community profile. U.S. Fish Wildl. Serv., Biol. Rept. 85(7.19), 73 p.

282. Noah, M. D. 1985. Appendix A. Structure, abundance and distribution of the fish and macroinvertebrate communities inhabiting Mission Bay, California between November 1979 and February 1981. *In* E. A. Weirich, M. D. Noah, and S. J. Schwartz (preparers), San Diego River and Mission Bay improvements, Draft suppl. environ. assess., 37 p. plus appendices. U.S. Army Corps Eng., Los Angeles, CA.

283. Nordby, C. S. 1982. A comparative ecology of ichthyoplankton within Tijuana estuary and in adjacent nearshore waters. M.S. thesis, San Diego State Univ, San Diego, CA, 101 p.

284. Nordby, C. S. 1987. Tijuana River National Estuarine Research Reserve. NOAA Tech. Memo, NOS, Mar. Est. Manage. Div., Washington, D.C., 12 p. plus tables.

285. Nordby, C., J. Zedler, and R. Gersberg. 1988. Fish and benthic invertebrate dynamics: responses to wastewater influxes. Prog. Rept. No. 3 to NOAA, Off. Coast. Res. Manage., Sanct. Prog. Div. Biol. Dept., San Diego State Univ, San Diego, CA, 15 p.

286. North, W. J., and C. L. Hubbs (compilers and editors). 1968. Utilization of kelp-bed resources in southern California. Calif. Fish Game, Fish Bull. 139:1-264.

287. Northwest Indian Fisheries Commission and Washington Department of Fisheries. 1986. Puget Sound salmon management periods and their derivations. Northw. Ind. Fish. Comm. and Wash. Dept. Fish., Olympia, WA, 16 p.

288. Nosho, T. Y., and K. K. Chew. 1972. The setting and growth of the Manila clam, *Venerupis japonica* (Deshayes) in Hood Canal, Washington. Proc. Natl. Shellfish Assoc. 62:50-58.

289. Nybakken, J., G. Cailliet, and W. Broenkow. Ecologic and hydrographic studies of Elkhorn Slough Moss Landing Harbor and nearshore coastal waters. Moss Landing Marine Laboratories, Moss Landing, CA, 465 p.

290. Oakley, A. R. 1966. A summary of information concerning chum salmon in Tillamook Bay. Res. Briefs Fish Comm. Oregon 12(1):5-21.

291. Oceanographic Institute of Washington. 1981. Clam and mussel harvesting industries in Washington State. Ocean. Inst. Wash., Seattle, WA, various pagination.

292. Odemar, M. W. 1964. Southern range extension of the eulachon, *Thaleichthys pacificus*. Calif. Fish Game 50(4):305-307.

293. Odenweller, D. B. 1975. The life history of the shiner surfperch *Cymatogaster aggregata* Gibbons, in Anaheim Bay, California. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 107-115. Calif. Fish Game, Fish Bull. 165.

294. Oregon Department Fish and Wildlife, and Washington Department of Fisheries. 1987. Status report: Columbia River fish runs and fisheries 1960-1986. Oregon Dept. Fish Wildl., Portland, and Wash. Dept. Fish., Olympia, 78 p.

295. Packer, J. F. 1980. Prediction of Pacific oyster spatfall intensity in Dabob Bay. Prog. Rept. 126, Wash. Dept. Fish., Olympia, 80 p.

296. Pauley, G. B., B. M. Bortz, and M. F. Shepard. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) - steelhead trout. Biol. Rept. 82(11.62), U.S. Fish Wildl. Serv., U.S. Army Corps Eng., TR EL-82-4. 24 p.

297. Pautzke, C. F., and R. C. Meigs. 1941. Studies on the life history of the Puget Sound steelhead trout (*Salmo gairdnerii*). Trans. Am. Fish. Soc. 70:209-220.

298. Pearcy, W., G., and S. S. Myers. 1974. Larval fishes of Yaquina Bay, Oregon: a nursery ground for marine fishes? Fish. Bull., U.S. 72(1):201-213.

299. Pearson, D. E. 1985. Environmental factors influencing English sole (*Parophrys vetulus*) populations in San Francisco Bay, California. M.S. thesis, Univ. Pacific, Stockton, CA, 103 p.

300. Pedersen, M. G., and G. DiDonato. 1982. Groundfish management plan for Washington's inside waters. Prog. Rept. 170, Wash. Dept. Fish., Olympia, 97 p.

301. Pedersen, M. G., M. L. Mills, M. Gosho. 1978. Bottomfish studies in Hood Canal, Washington. Prog. Rept. 54, Wash. Dept. Fish., Olympia, 38 p.

302. Peeling, T. J. 1974. A proximate biological survey of San Diego Bay, California Rept. No. NUC TP 389, Biosystems Res. Dept., Naval Undersea Cent., San Diego, CA, 83 p.

303. Penttila, D. 1978. Studies of the surf smelt (*Hypomesus pretiosus*) in Puget Sound. Tech. Rept. No. 42, Wash. Dept. Fish., Olympia, 47 p.

304. Peterson, C. H. 1982. The importance of predation and intra- and interspecific competition in the population biology of two infaunal suspension-feeding bivalves, *Protothaca staminea* and *Chione undatella* Ecol. Monogr. 52(4):437-475.

305. Peterson, C. H., and M. L. Quammen. 1982. Siphon nipping: its importance to small fishes and its impact on growth of the bivalve *Protothaca staminea* (Conrad). J. Exp. Mar. Biol. Ecol. 63:249-268.

306. Phillips, L., C. Terry, and J. Stephens. 1972. Status of the white croaker (*Genyonemus lineatus*) in the San Pedro region. Dept. of Biol., Occidental Coll., Los Angeles, CA, 47 p.

307. Phillips, R. E., D. I. Gutoff, J. E. Hansen, and J. E. Hardwick. 1986. Distribution of major marine macrophytes, seasonal estimates of *Gracilaria* standing crop, and spawning activities of the Pacific herring, *Clupea harengus pallasii*, in Elkhorn Slough, California; 1979-1982. Calif. Fish Game 72(4):232-243.

308. Phinney, L. A., P. Bucknell, and R. Williams. 1975. A catalog of Washington streams and salmon utilization. Volume 2. Coastal region. Wash. Dept. Fish., Olympia, various pagination.

309. Poole, R. L. Preliminary results of the age and growth study of the market crab, *Cancer magister* in California: the age and growth of *Cancer magister* in Bodega Bay. Proc. Symp. Crustacea, Mar. Biol. Assoc. India, Ernakulam, Part II:553-567.

310. Porter, R. G. 1974. Reproductive cycle of the softshell clam, *Mya arenaria*, at Skagit Bay, Washington. Fish. Bull., U.S. 72(3):648-656.

311. Prasad, R. R. 1948. The life history of *Clevelandia ios* (Jordan and Gilbert). Ph.D. thesis, Stanford Univ., Palo Alto, CA, 141 p.

312. Prinslow, J. E., K. M. McDowell, and C. A. Simenstad. 1981. Distribution and abundance of juvenile salmonids. *In* C. A. Simenstad and D. M. Eggers (preparers), Juvenile salmonid and baitfish distribution, abundance and prey resources in selected areas of Grays Harbor, Washington, p. 25-60. Final Rept. to U.S. Army Corps Eng., Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, WA.

313. Puckett, L. K. 1977. The Eel River estuary - observations on morphometry, fishes, water quality and invertebrates. Memo. Rept., 26 p. plus appendix, Calif. Dept. Fish Game, Sacramento.

314. Pycha, R. L. 1956. Progress report on white sturgeon studies. Calif. Fish Game 42(1):23-35.

315. Quast, J. C. 1968. Observations on the food and biology of the kelp bass, *Paralabrax clathratus* with notes on its sportfishery at San Diego, California. *In* W. J. North and C. L. Hubbs (compilers and editors), Utilization of kelp-bed resources in southern California, p. 81-108. Calif. Fish Game, Fish Bull. 139.

316. Quayle, D. B. 1969. Pacific oyster culture in British Columbia. Fish. Res. Board Can., Bull. 169, 192 p.

317. Quayle, D. B., and N. Bourne. 1972. The clam fisheries of British Columbia. Fish. Res. Board Can., Bull. 179, 70 p.

318. Rabin, D. J. 1976. Population characteristics of Pacific herring, *Clupea harengus pallasi*, in Humboldt Bay, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 44 p.

319. Rabin, D. J., and R. A. Barnhart. 1986. Population characteristics of Pacific herring, *Clupea harengus pallasi*, in Humboldt Bay, California. Calif. Fish Game 72(1):4-16.

320. Radovich, J. 1963. Effects of ocean temperature on the seaward movements of striped bass,

Roccus saxatilis , on the Pacific coast. Calif. Fish Game 49(3):191-206.

321. Radtke, L. D. 1966. Distribution of smelt, juvenile sturgeon, and starry flounder in the Sacramento-San Joaquin Delta with observations on food of sturgeon. *In* J. L. Turner and D. W. Kelley (compilers), Ecological studies of the Sacramento-San Joaquin Delta, Part II, Fishes of the Delta, p. 115-129. Calif. Fish Game, Fish Bull. 136.

322. Ratti, F. 1979a. Natural resources of Rogue estuary. Est. Inven. Rept. 2(3), Oregon Dept. Fish Wildl., Corvallis, 33 p.

323. Ratti, F. 1979b. Natural resources of Umpqua estuary. Est. Inven. Rept. 2(5), Oregon Dept. Fish Wildl., Corvallis, 55 p.

324. Raugh, A. A. 1976. Feeding habits of silversides (Family Atherinidae) in Elkhorn Slough, Monterey Bay, California. M.A. thesis, Calif. State Univ., Fresno, 60 p.

325. Reaves, R. 1986. Chinook salmon spawning stocks in California's central valley, 1983. Admin. Rept. 86-01, Calif. Dept. Fish Game, Anad. Fish Branch, Sacramento, 39 p.

326. Reilly, P. N. 1983. Predation on Dungeness crabs, *Cancer magister*, in central California. *In* P. W. Wild and R. N. Tasto (editors), Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister* with emphasis on the central California fishery resource, p. 155-164. Calif. Fish Game, Fish Bull. 172.

327. Reish, D. J. 1964. Studies on the *Mytilus edulis* community in Alamitos Bay, California, I: Development and destruction of the community. Veliger 6(3):124-131.

328. Reish, D. J. 1968. Marine life of Alamitos Bay. Forty-Niner Shops, Inc. 92 p.

329. Reish, D. J., T. J. Kauwling, and T. C. Schrieber. 1975. Annotated checklist of the marine invertebrates of Anaheim Bay. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 41-51. Calif. Fish Game, Fish Bull. 165.

330. Richardson, S. L., and W. G. Pearcy. 1977. Coastal and oceanic fish larvae in an area of upwelling off Yaquina Bay, Oregon. Fish. Bull., U.S. 75(1):125-145.

331. Ricketts, E. F., J. Calvin, J. W. Hedgpeth, and D. W. Phillips. 1985. Between Pacific tides. Stanford Univ. Press, Stanford, CA, 652 p.

332. Robinson, A. M., and W. P. Breese. 1982. The spawning season of four species of clams in Oregon. J. Shellfish Res. 2(1):55-57.

333. Roffe, T. J. 1980. Population, food habits, and behavior of pinnipeds in the Rogue River and their relationship to salmonid runs. Ph.D. thesis. Oregon State Univ., Corvallis, 173 p.

334. Rogers, D. 1985. Population dynamics of juvenile flatfish in Grays Harbor estuary and adjacent nearshore area. M.S. thesis, Univ. Wash., Seattle, 81 p.

335. Rosenberg, A. A. 1982. Growth of juvenile English sole, *Parophrys vetulus*, in estuarine and open coastal nursery grounds. Fish. Bull., U.S. 80(2):245-252.

336. Rowell, D. L. 1981. The dispersal of *Cancer magister* larvae in the Coos Bay estuary. M.S. thesis, Univ. Oregon, Eugene, 66 p.

337. Roye, C. 1979. Natural resources of Coos Bay estuary. Oregon Dept. Fish Wildl., Corvallis, 87 p.

338. Salo, E. O., N. J. Bax, T. E. Prinslow, C. J. Whitmus, B. P. Snyder, and C. A. Simenstad. 1980. The effects of construction of naval facilities on the outmigration of juvenile salmonids from Hood Canal, Washington. Final Rept. to U.S. Navy, Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, FRI-UW-8006, 159 p.

339. Samuelson, C. E. 1973. Fishes of south Humboldt Bay, Humboldt County, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 94 p.

340. Samuelson, C. E., D. C. Fagergren, and E. G. Hoffman. 1977. Grays Harbor division support: final report-estuarine assessment programs, 1975-1977. ITT Rayonier Inc., Shelton, WA, 73 p.

341. San Diego Gas and Electric. 1980a. Silver gate power plant cooling water intake system demonstration (in accordance with section 316(b) Federal Water Pollution Control Act Amendment of 1972). Rept. to Calif. Reg. Water Qual. Control Board, San Diego Gas and Elec., San Diego, CA, various pagination.

342. San Diego Gas and Electric. 1980b. South Bay power plant cooling water intake system demonstration (in accordance with section 316(b) Federal Water Pollution Control Act Amendment of 1972). Rept. to Calif. Reg. Water Qual. Control Board, San Diego Gas and Elec., San Diego, CA, various pagination.

343. San Diego Gas and Electric. 1980c. Station B power plant cooling water intake system demonstration (in accordance with section 316(b) Federal Water Pollution Control Act Amendment of 1972). Rept. to Calif. Reg. Water Qual. Control Board, San Diego Gas and Elec., San Diego, CA, various pagination.

344. Sasaki, S. 1966a. Distribution and food habits of king salmon, *Oncorhynchus tshawytscha*, and steelhead rainbow trout, *Salmo gairdnerii*, in the Sacramento-San Joaquin delta. *In* J. L. Turner and D. W. Kelley (editors), Ecological studies of the Sacramento-San Joaquin delta. Part II, p. 108-114. Calif. Fish Game, Fish Bull. 136.

345. Sasaki, S. 1966b. Distribution of young striped bass, *Roccus saxatilis*, in the Sacramento-San Joaquin delta. *In* J. L. Turner and D. W. Kelley (editors), Ecological studies of the Sacramento-San Joaquin delta. Part II, p.44-58. Calif. Fish Game, Fish Bull. 136.

346. Sasaki, S. 1966c. Distribution of juvenile striped bass, *Roccus saxatilis*, in the Sacramento-San Joaquin delta. *In* J. L. Turner and D. W. Kelley (editors), Ecological studies of the Sacramento-San Joaquin delta. Part II, p. 59-67. Calif. Dept. Fish Game, Fish Bull. 136.

347. Schultz, L. P. 1933. Age and growth of *Atherinops affinis oregonia* Jordan and Snyder and of other subspecies of baysmelt along the Pacific Coast on the United States. Wash. State Univ. Publ. Biol. 2(3):45-102.

348. Seapy, R. R. 1981. Structure, distribution, and seasonal dynamics of the benthic community in the upper Newport Bay, California. Mar. Res. Tech. Rept. No. 46, Calif. Dept. Fish Game, Sacramento, 74 p.

349. Seapy, R. R., and C. L. Kitting. 1978. Spatial structure of an intertidal molluscan assemblage on a sheltered sandy beach. Mar. Biol. 46:117-145.

350. Seiler, D., S. Neuhauser, and M. Ackley. 1981. Upstream/downstream salmonid trapping project, 1977-1980. Prog. Rept. 144, Wash. Dept. Fish., Olympia, 197 p.

351. Shapiro and Associates, Inc. 1980. Humboldt Bay wetland review and baylands analysis. Vol. 2, Base information. Shapiro and Associates., Inc., Seattle, WA, 3 Vol., various pagination.

352. Shapovalov, C., and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*). Calif. Fish Game, Fish Bull. 98:1-375

353. Shaw, E. 1971. Evidence of sexual maturation in young adult shiner perch, *Cymatogaster aggregata* Gibbons (Perciformes, Embiotocidae). Amer. Mus. Nov. 2479:1-10.

354. Shaw, E., J. Allen, and R. Stone., 1974. Notes on collections of shiner perch, *Cymatogaster aggregata* in Bodega Harbor, California. Calif. Fish Game 60(1):15-22.

355. Shaw, W. N. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—common littleneck clam. Biol. Rept. 82(11.46), U.S. Fish Wildl. Serv. U.S. Army Corps Eng., TR EL-82-4, 11 p.

356. Sigfried, C. A. 1980. Seasonal abundance and distribution of *Crangon franciscorum* and *Palaemon macrodactylus* (Decapoda, Caridea) in the San Francisco Bay-delta. Biol. Bull. 159:177-192

357. Simel, N. R. 1980. Aspects of the ecology of *Mya arenaria* L. in Humboldt Bay, California. M. A. thesis, Humboldt State Univ., Arcata, CA, 90 p.

358. Simenstad, C. A., and D. M. Eggers. 1981. Juvenile salmonid and baitfish distribution, abundance, and prey resources in selected areas of Grays Harbor, Washington. Final Rept. to Seattle Dist., Corps Eng., Fish. Res. Inst., Coll. Fish., Seattle, WA, 205 p.

359. Simenstad, C. A., K. L. Fresh, and E. O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. *In* V. S. Kennedy (editor), Estuarine Comparisons, p. 343-364. Academic Press, Inc., New York.

360. Skidmore, D. A. 1983. Settlement, growth, and survival of *Mytilus edulis*, L. in Puget Sound and assessment of *Mytilus californianus* for aquaculture. M.S. thesis, Univ. Wash., Seattle, 99 p.

361. Skidmore, D. A., and K. K. Chew. 1985. Mussel aquaculture in Puget Sound. Wash. Sea

Grant Prog., Univ. Wash., Seattle, 57 p.

362. Skinner, J. E. 1962. An historical review of the fish and wildlife resources of the San Francisco Bay area. Water Proj. Branch Rept. No. 1. Calif. Dept. Fish Game, Sacramento, 226 p.

363. Smith, A. K. 1967. Population dynamics and ecology of the embiotocids of Humboldt Bay, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 84 p.

364. Smith, A. K., and J. E. Lauman. 1972. Fish and wildlife resources of the middle coast basin, Oregon, and their water requirements, 1972. Oregon State Game Comm., Portland, 98 p.

365. Smith, C. L., and P. H. Young. 1966. Gonad structure and the reproductive cycle of the kelp bass, *Paralabrax clathratus* (Girard), with comments on the relationships on the serranid genus *Paralabrax*. Calif. Fish Game 52(4):283-292.

366. Smith, J. L., O. Bengstrom, and J. Brown. 1976. Appendix G: Fish. *In* Maintenance dredging and the environment of Grays Harbor, Washington, p. 1-123. U.S. Army Corps Eng., Seattle, WA, 125 p.

367. Smith, S. In prep. Seasonal distribution patterns of leopard sharks (*Triakis semifasciata*) tagged in San Francisco Bay. Available Southwest Fish Cent., P.O. Box 271, La Jolla, CA, 92038.

368. Smith, S., and R. B. Herrmann. 1972. Clam distributions and abundances in Willapa Bay and Grays Harbor as related to environmental conditions. Summ. Rept., Weyerhaeuser Company, Longview, WA, 53 p.

369. Snyder, H. G. 1965. Some larval fishes of Mission Bay, San Diego County, California. M.S. thesis, San Diego State Univ., San Diego, CA, 43 p.

370. Sopher, T. R. 1974. A trawl survey of the fishes of Arcata Bay, California. M.S. thesis. Humboldt State Univ., Arcata, CA, 103 p.

371. Soule, D. F., and M. Oguri (editors). 1980. The marine environment in Los Angeles and Long Beach Harbors during 1978. Marine studies of San Pedro Bay, California, part 17. Harbors Envir. Proj., Allan Hancock Found. and Off. Sea Grant Prog., Inst. for Mar. and Coast. Stud., Univ. South. Calif., Los Angeles, CA, 667 p.

372. Soule, D. F., and M. Oguri (editors). 1987. The marine environment of Marina Del Rey, California in 1986. Marine studies of San Pedro Bay, California-part 20C, Harbors Envir. Proj., Univ. South. Calif., Los Angeles, CA, 142 p. plus appendices.

373. Southern California Coastal Water Research Project. 1973. The ecology of the southern California Bight: Implication for water quality management. Chapt. 7, Coastal Fish Populations, p. 193-203. South. Calif. Coast. Water Res. Proj., Long Beach, CA.

374. Span, J. 1968. Student report on shrimp of Humboldt Bay for California Fish and Game, Unpubl. Rept., various pagination, Calif. Dept. Fish Game, Eureka.

375. Span, J. A. 1978. Successful reproduction of giant Pacific oysters in Humboldt Bay and Tomales Bay, California. Calif. Fish Game 64(2):123-124.

376. Speth, J. W., B. M. Browning, K. A. Smith, E. C. Fullerton, and B. M. Massey. 1976. The Natural resources of Anaheim Bay - Huntington Harbor. Coast. Wetl. Ser. No. 18. Calif. Dept. Fish Game, Sacramento, 103 p. plus appendices.

377. Spratt, J. D. 1981. Status of the Pacific herring, *Clupea harengus pallasii*, resource in California 1972 to 1980. Calif. Fish Game, Fish Bull. 171, 107 p.

378. Spratt, J. D. 1982. Results of sampling clammers in Elkhorn Slough during 1978 and 1979. Adm. Rep. 82-11, Calif. Dept. Fish Game, Monterey, 121 p.

379. Spratt, J. D. 1983. Biomass estimates of Pacific herring, *Clupea harengus pallasi*, in California from the 1980-81 spawning ground surveys. *In* K. Buchanan (editor), Proceedings of the fourth Pacific coast herring workshop, October 7-8, 1981, p. 105-111. Can. Manusc. Rept. Fish. Aquat. Sci. No. 1700.

380. Spratt, J. D. 1984. Biomass estimate of Pacific herring, *Clupea harengus pallasi*, in California from the 1983-84 spawning-ground surveys. Mar. Res. Admin. Rept. No. 84-2. Calif. Dept. Fish Game, Monterey, 29 p.

381. Spratt, J. D. 1987. Biomass estimate of Pacific herring, *Clupea harengus pallasi*, in California from the 1986-87 spawning-ground surveys. Mar. Res. Admin. Rept. No. 87-12, Calif. Dept. Fish Game, Monterey, 29 p.

382. Squire, J. L., Jr., and S. E. Smith. 1977. Anglers' guide to the United States Pacific Coast. U.S. Dept. Comm., Natl. Ocean. Atm. Adm., Natl. Mar. Fish. Serv., Seattle, WA, 139 p.

383. Standing, J., B. Browning, and J. W. Speth. 1975. The natural resources of Bodega Harbor. Coast. Wetl. Ser. No. 11, Calif. Dept. Fish Game, Sacramento, 183 p.

384. Starr, R. 1979. Natural resources of Siletz estuary. Oregon Dept. Fish Wildl., Corvallis, 44 p.

385. Steinfeld, J. D. 1971. Distribution of Pacific herring spawn in Yaquina Bay, Oregon, and observations on mortality through hatching. M.S. thesis, Oregon State Univ., Corvallis, 75 p.

386. Stephens, J. S., Jr., G. A. Jordan, P. A. Morris, M. M. Singer, and G. E. McGowen. 1986. Can we relate larval fish abundance to recruitment or population stability? A preliminary analysis of recruitment to a temperate rocky reef. Calif. Coop. Ocean. Fish. Invest. 27:65-83.

387. Stephens, J. S., Jr., P. A. Morris, and W. Westphal. 1983. Assessing the effects of a coastal stream electric generating station of fishes occupying its receiving waters. *In* D. F. Soule and D. Walsh (editors), Waste disposal in the oceans, minimizing impact, maximizing benefits, p. 194-208. Westview Press, Boulder, CO.

388. Stephens, J. S., Jr., C. Terry, and M. J. Allen. 1974. Abundance, distribution, seasonality and productivity of the fish populations in Los Angeles Harbor, 1972-73. *In* D. F. Soule, and M. Oguri (editors), Marine studies of San Pedro Bay, California. Part IV, p. 1-42. Allan Hancock Found., Sea Grant Prog., Univ. South. Calif., Los Angeles.

389. Stevens, B. G., and D. A. Armstrong. 1984. Distribution, abundance, and growth of juvenile Dungeness crabs, *Cancer magister*, in Grays Harbor estuary, Washington. Fish. Bull., U.S. 82(3):469-483.

390. Stevens, D. E. 1966. Distribution and food habits of the American shad, *Alosa sapidissima*, in the Sacramento-San Joaquin Delta. *In* J. L. Turner and D. W. Kelley (compilers), Ecological studies of the Sacramento-San Joaquin Delta, Part II, Fishes of the Delta, p. 97-107. Calif. Fish Game, Fish Bull. 136.

391. Stevens, D. E. 1972. American shad. *In* J. E. Skinner (compiler), Ecological studies of the Sacramento-San Joaquin estuary, p. 52-54. Delta Fish Wildl. Proj. Study, Rept. No. 8, Calif. Dept. Fish Game, Sacramento.

392. Stevens, D. E., H. K. Chadwick, and R. E. Painter. 1987. American shad and striped bass in California's Sacramento-San Joaquin River system. Am. Fish. Soc. Symp. 1:66-78.

393. Stevens, D. E., and L W. Miller. 1970. Distribution of sturgeon larvae in the Sacramento-San Joaquin River system. Calif. Fish Game 56(2):80-86.

394. Stevens, D. E., and L W. Miller. 1983. Effects of river flow on abundance of shad, longfin smelt, and delta smelt in the Sacramento-San Joaquin River system. N. Am. J. Fish. Manage. 3:425-437.

395. Stober, Q. J., D. T. Griggs, and D. L. Mayer. 1973. Species diversity of the marine fish community in north Skagit Bay. *In* Q. J. Stober, and E. O. Salo (editors), Ecological studies of the proposed Kiket Island nuclear power site, p. 373-400. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle.

396. Stober, Q. J., and K. B. Pierson. 1984. A review of the water quality and marine resources of Elliott Bay, Seattle, Washington. Final Rept., Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle, 118 p.

397. Stober, Q. J., S. J. Walden, and D. T. Griggs. 1973. Juvenile salmonid migration through north Skagit Bay. *In* Q. J. Stober, and E. O. Salo (editors), Ecological studies of the proposed Kiket Island nuclear power site, p. 35-70. Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle.

398. Stockley, C. 1981. Columbia River sturgeon. Prog. Rept. 150, Wash. Dept. Fish., Olympia, 28 p.

399. Stout, H. (editor) 1976. The natural resources and human utilization of Netarts Bay, Oregon. Oregon State Univ., Corvallis, 247 p.

400. Stout, W. E. 1967. A study of the autecology of the horseneck clams *Tresus capax* and *Tresus nuttalli* in south Humboldt Bay, California. M.A. thesis, Humboldt State Univ., Arcata, CA, 51 p.

401. Suer, A. L. 1987. The herring of San Francisco and Tomales Bays. The Ocean Res. Inst., San Francisco, CA, 64 p.

402. Sumner, F. H. 1962. Migration and growth of the cutthroat trout in Tillamook County, Oregon. Trans. Am. Fish. Soc. 91(1):77-83.

403. Talbot, G. B. (no date). Passage of shad at the Bonneville fishways. U.S. Fish Wildl. Serv., Spec. Sci. Rept. (Fish.) No. 94, 30 p.

404. Talent, L. 1973. The seasonal abundance and food of Elasmobranchs occurring in Elkhorn Slough, Monterey Bay, California. M.A. thesis, Calif. State Univ., Fresno, 58 p.

405. Tasto, R. N. 1975. Aspects of the biology of the Pacific staghorn sculpin, *Leptocottus armatus*, in Anaheim Bay. *In* E. D. Lane and C. W. Hill (editors), The marine resources of Anaheim Bay, p. 123-135. Calif. Fish Game, Fish Bull. 165.

406. Tasto, R. N. 1983. Juvenile Dungeness crab, *Cancer magister*, studies in the San Francisco Bay area. *In* P. W. Wild and R. N. Tasto (editors), Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister*, with emphasis on the central California fishery resource, p. 135-153. Calif. Fish Game, Fish Bull. 172.

407. Temple, R., and A. Mirati. 1986. Striped bass and salmonid management issues in Coos Bay, Oregon. Section 1: potential impacts of striped bass on salmonids. Oregon Dept. Fish Wildl., Portland, OR, 20 p.

408. Thompson, K. E., and J. D. Fortune, Jr. 1970. Fish and wildlife resources of the Rogue basin, Oregon, and their water requirements. Oregon State Game Comm., Portland, 108 p.

409. Thompson, K. E., A. K. Smith, and J. E. Lauman. 1972. Fish and wildlife resources of the south coast basin, Oregon, and their water requirements (revised). Oregon State Game Comm., Portland, 98 p.

410. Tomasson, T. 1979. Age and growth of cutthroat trout, *Salmo clarki* Richardson, in the Rogue River, Oregon. M.S. thesis, Oregon State Univ., Corvallis, 75 p.

411. Trumble, R. J. 1973. Underutilized fishery resources of the Northeast Pacific. *In* N. M. Ehrhardt and C. T. Bledsoe (editors), Marine fisheries of the Northeastern Pacific: a synopsis. Norfish Pap. No. 14, Wash. Sea Grant, Univ. Wash., Seattle.

412. Trumble, R. J. 1983. Management plan for baitfish species in Washington state. Prog. Rept. 195, Wash. Dept. Fish., Olympia, 106 p.

413. Turner, J. L. 1972. Striped bass. *In* J. E. Skinner (compiler), Ecological studies of the Sacramento-San Joaquin estuary, p. 36-43. Delta Fish and Wildl. Proj., Study 8, Calif. Dept. Fish Game, Stockton.

414. Turner, J. L., and H. K. Chadwick. 1972. Distribution and abundance of young-of-the-year striped bass, *Morone saxatilis*, in relation to river flow in the Sacramento-San Joaquin estuary. Trans. Am. Fish. Soc. 3:442-452.

415. Tuss, D., T. Kisanuki, J. Larson, J. Polos, and T. Frazer. 1987. Klamath River fisheries investigation program. Annual report 1986, U.S. Fish and Wildl. Serv., Arcata, CA, 93 p.

416. Tuss, D., J. Larson, T. Kisanuki, J. Polos, and J. Craig. 1988. Klamath River fisheries investigation program. Annual report 1987, U.S. Fish and Wildl. Serv., Arcata, CA, 101 p.

417. Tyler, R. W. 1964. Distribution and migration of young salmon in Bellingham, Washington. Circ. No. 212, Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle.

418. U.S. Army Corps of Engineers. 1975. The Siuslaw estuary and the Umpqua estuary, including the Smith River. Final Environmental Impact Statement, U.S. Army Corps Eng., Portland, OR, various pagination.

419. U.S. Army Corps of Engineers. 1976a. Alsea wetland review. U.S. Army Corps Eng., Portland, OR, 345 p.

420. U.S. Army Corps of Engineers. 1976b. Environmental evaluation of the Willapa River and harbor navigation project, Pacific County, Washington. U.S. Army Corps Eng., Seattle, WA, various pagination.

421. U.S. Army Corps of Engineers. 1976c. Yaquina Bay environmental impact statement. U.S. Army Corps Eng., Portland, OR, various pagination.

422. U.S. Army Corps of Engineers. 1978. Extension of Tillamook south jetty Tillamook Bay, Oregon. Environmental impact statement, U.S. Army Corps of Eng., Portland, OR, various pagination.

423. U.S. Department of Interior. 1970. Fish and wildlife of Willapa Bay, Washington. U.S. Fish Wildl. Serv., Portland, OR, 18 p.

424. U.S. Fish and Wildlife Service. 1970. Effects on fish resources of dredging and spoil disposal in San Francisco and San Pablo Bays, California. U.S. Fish Wildl. Serv., 36 p.

425. U.S. Fish and Wildlife Service. 1987. The needs of chinook salmon, *Oncorhynchus tshawytscha* in the Sacramento-San Joaquin estuary. Exhibit 31, entered by the U.S. Fish and Wildlife Service for the State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding on the San Francisco Bay/Sacramento-San Joaquin Delta. U.S. Fish Wildl. Serv. , Stockton, CA,179 p.

426. Van Cleve, R., and S. Z. El-Sayed. 1969. Age, growth, and productivity of an English sole population in Puget Sound, Washington. Pac. Mar. Fish. Comm., Bull. 7:51-72.

427. Vrat, V. 1949. Reproduction, behavior, and development of eggs of the three-spined stickleback (*Gasterosteus aculeatus*) of California. Copeia 1949(4):252-260.

428. Waddell, J. E. 1964. The effect of oyster culture on eelgrass (*Zostera marina* L.) growth. M.S. Thesis, Humboldt State Univ., Arcata, CA, 48 p.

429. Wagoner, L. J., K. K. Jones, R. E. Bender, J. A. Butler, D. E. Demory, T. F. Gaumer, W. G. Mullarkey, N. T. Richmond, and T. J. Rumreich. 1988. Coos Bay fish management plan. Draft No. 3, Oregon Dept. Fish Wildl., Corvallis, 127 p.

430. Wahle, R. J., and R. E. Pearson. 1987. A listing of Pacific coast spawning streams and hatcheries producing chinook and coho salmon with estimates on numbers of spawners and data on hatchery releases. NOAA Tech. Memo. NMFS F/NWC-122, 109 p.

431. Waldron, K. D. 1972. Fish larvae collected from the Northeastern Pacific Ocean and Puget Sound during April-May 1967. NOAA Tech. Rept. , Natl. Mar. Fish. Serv., Spec. Sci. Rept. No. 663, 16 p.

432. Waldvogel, J. B. 1977. Age, maturity, and distribution of northern anchovy, *Engraulis mordax*, in Humboldt Bay, California. M.S. thesis, Humboldt State Univ., Arcata, CA, 36 p.

433. Walters. G. 1984. Ecological aspects of larval and juvenile Pacific cod (*Gadus macrocephalus*), walleye pollack (*Theragra chalcogramma*), and Pacific tomcod (*Microgadus proximus*) in Port Townsend, Washington. M.S. thesis, Univ. Wash., Seattle, 16 p.

434. Wang, J. C. S. 1981. Taxonomy of the early life stages of fishes: fishes of the Sacramento-San Joaquin estuary and Moss Landing Harbor-Elkhorn Sough, California. Ecological Analysts, Inc., Concord, CA, 168 p.

435. Wang, J. C. S. 1986. Fishes of the Sacramento-San Joaquin estuary and adjacent waters, California: a guide to the early life histories. Tech. Rept No. 9, prepared for the Interagency Ecol. Study Prog. for the Sacramento-San Joaquin Estuary, Calif. Dept. Water Res., Calif. Dept. Fish Game, U.S. Bureau Recl., U.S. Fish Wildl. Serv., various pagination.

436. Washington Department of Fisheries. 1977. Status of Puget Sound coho salmon and recommendations for management. Prog. Rept. 24, Wash. Dept. Fish., Olympia, 9 p.

437. Washington Department of Fisheries and Washington Department of Ecology. 1985. Use of the insecticide SEVIN to control ghost and mud shrimp in oyster beds of Willapa Bay and Grays Harbor. Final Environ. Impact Statement, Wash. Dept. Fish. and Wash. Dept. Ecol., Olympia, 64 p. plus appendices.

438. Washington, P. M. 1977. Recreationally important marine fishes of Puget Sound, Washington. Proc. Rept., 122 p., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

439. Watson, W. 1982. Development of eggs and larvae of the white croaker, *Genyonemus lineatus* Ayres (Pisces: Sciaenidae), off the southern California coast. Fish. Bull., U.S. 80:403-417.

440. Wendell, F. 1973. Ecology of the gaper clam, *Tresus capax* (Gould 1850), in Humboldt Bay California. M.S. thesis, Humboldt State Univ., Arcata, CA, 37 p.

441. Wendell, F., J. D. DeMartini, P. Dinnel, and J. Siecke. 1976. The ecology of the gaper or horse clam, *Tresus capax* (Gould 1850) (Bivalvia: Mactridae), in Humboldt Bay, California. Calif. Fish Game 62(1):41-64.

442. Westerheim, S. J. 1955. Size composition, growth, and seasonal abundance of juvenile English sole (*Parophrys vetulus*) in Yaquina Bay. Fish. Comm. Oregon, Res. Briefs 6(1):33-37.

443. White, W. S. 1977. Taxonomic composition, abundance, distribution and seasonality of fish eggs and larvae in Newport Bay, California. M.S. thesis, Calif. State Univ., Fullerton, 107 p.

444. White, W. S., R. C. Wunderlich, and R. M. Jurek. 1978. The natural resources of Tijuana estuary. Draft Rept., 54 p., Calif. Dept. Fish Game, San Diego, CA.

445. Wickham, D. E., R. Shieser, and A. Schuur. 1976. Observations on the inshore population of Dungeness crabs in Bodega Bay. Calif. Fish Game 62(1):89-92.

446. Wiebe, J. 1968. The reproductive cycle of the viviparous sea perch, *Cymatogaster aggregata* Gibbons. Can. J. Zool. 46:1221-1234.

447. Williams, G. T. 1983. Distribution and relative abundance of major epibenthic Crustacea in the Columbia River estuary. M.S. thesis, Univ. Wash., Seattle, 98 p.

448. Williams, R. W., R. M. Laramie, J. J. Ames. 1975. A catalog of Washington streams and salmon utilization. Volume 1. Puget Sound region. Wash. Dept. Fish., Olympia, WA, various pagination.

449. Wilson, D. C., and R. E. Milleman. 1969. Relationships of female age and size to embryo number and size in the shiner perch, *Cymatogaster aggregata*. J. Fish. Res. Board Can. 26:2339-2344.

450. Woods, E. M. 1984. A survey of fishes utilizing a marsh restoration site in San Francisco Bay. M.A. thesis, San Francisco State Univ., San Francisco, CA, 57 p. plus tables and figures.

451. Wooster, T. W. 1968. Clams, native oysters and mussels. *In* D. W. Kelley, T. W. Wooster, W. Heubach, H. K. Chadwick, G. E. Delisle, D. Wolf, M. Oehler, G. Clark, and G. Boranian (preparers), Fish and wildlife resources of San Francisco Bay and delta: description, environmental requirements, problems, opportunities and the future, p.123-159. Calif. Dept. Fish Game, Sacramento.

452. Wydoski, R. S. and Whitney R. R. 1979. Inland fishes of Washington, Univ. Wash. Press, Seattle, 220 p.

453. Yoshinaka, M. S., and N. J. Ellifrit. 1974. Hood Canal - priorities for tomorrow: an initial report on fish and wildlife, developmental aspects and planning considerations for Hood Canal, Washington. U.S. Fish Wildl. Serv., Portland, OR, 109 p.

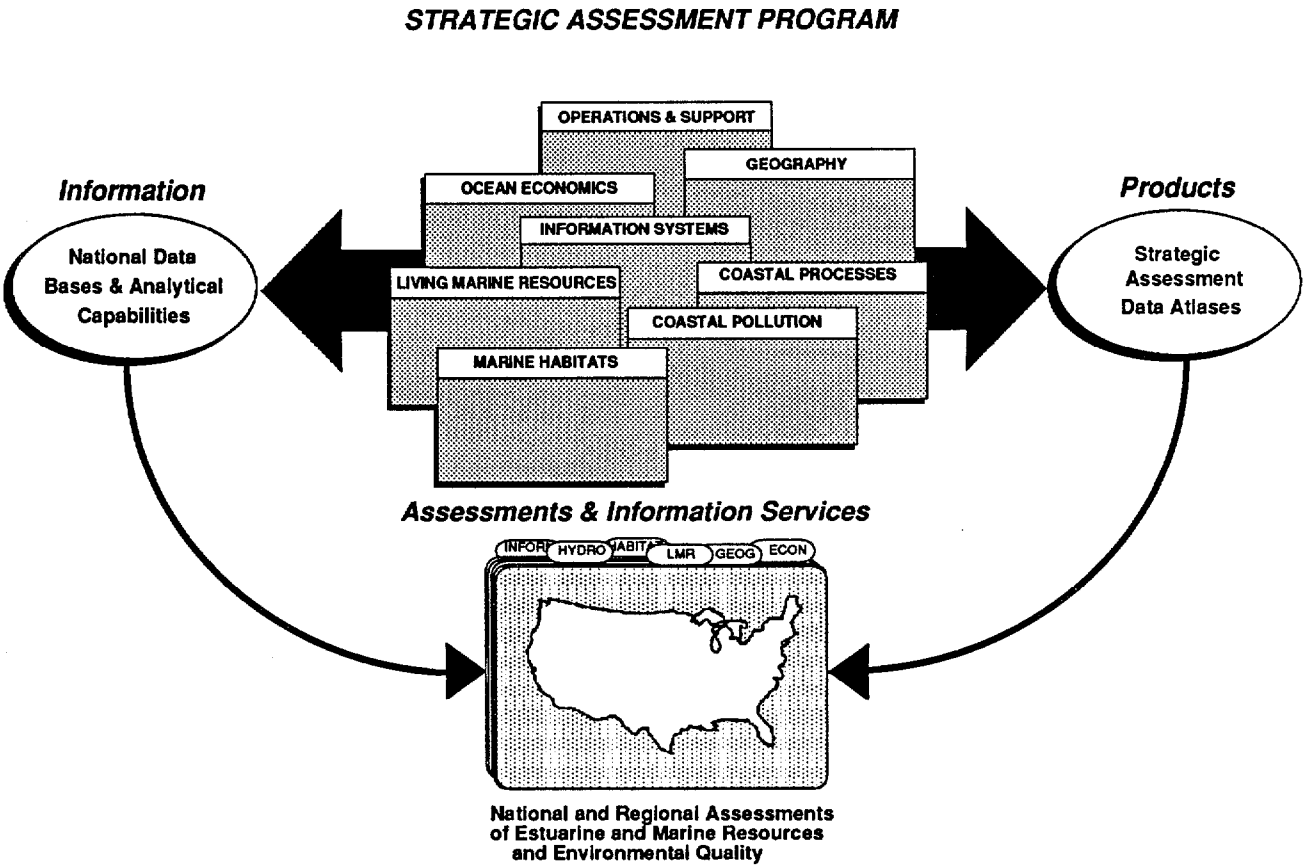
454. Young, J. S. 1984. Identification of larval smelt (Osteichthes: Salmoniformes: Osmeridae) from northern California. M. S. thesis. Humboldt State Univ., Arcata, CA, 90 pp.

455. Young, P. H. 1963. The kelp bass (*Paralabrax clathratus*) and its fishery, 1947-1958. Calif. Fish Game, Fish Bull. 122:1-67.

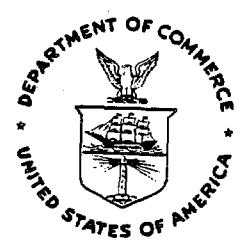
456. Zedler, J. B., and C. S. Nordby. 1986. The ecology of Tijuana Estuary, California: an estuarine profile. Biol. Rept. 85(7.5), U.S. Fish Wildl. Serv., 104 p.

NOAA's Program of Strategic Assessments

The major activities of the Strategic Assessment Program are focused on assembling information and providing assessment services required for decisionmaking about the estuarine and marine resources of the USA. The information and assessments that are developed help identify strategies for balanced conservation and use of these resources for maximum benefit to the Nation. Recent projects completed by the Branch include the *Bering, Chukchi, Beaufort Seas Strategic Assessment Data Atlas*, along with two *National Estuarine Inventory Data Atlases* and one pre-publication edition of the *West Coast of North America Data Atlas*. A continuing effort to expand and improve the National Estuarine Inventory (NEI) has resulted in the publication of NEI supplement reports. Several data bases, including the Estuarine Living Marine Resources (ELMR) data base, are being completed (see inside front cover). Data and analytical capabilities are being made more accessible through improvements in the Computer Mapping and Analysis System (Cmas) and development of the Coastal Ocean Management, Planning, and Assessment System (COMPAS). Assessment reports examining pesticide use in estuarine drainage areas, susceptibility of estuaries to nutrients, and quality of coastal shellfishing waters are also being completed.



The Strategic Assessment Program assembles and analyzes information to generate atlas products and assessment services on the multiple uses of the Nation's coastal ocean resources.



NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 00000 5712